Summary Report

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Session Background

As part of the World Engineers Convention (WEC) 2011 in Geneva, Switzerland September 4-9, the World Federation of Engineering Organizations Committee on Engineering and the Environment (WFEO-CEE) and Engineers Canada (who serves as chair of and secretariat for the committee) proposed a parallel session on climate change as part of the convention theme on urban development and buildings. Once accepted, WFEO-CEE and Engineers Canada collaborated to prepare an exciting agenda with two keynotes and two panels addressing adaptation and mitigation of infrastructure in a changing climate for engineers. Speakers brought knowledge and expertise based on projects undertaken in Europe, North America, Latin America and Africa. The session was chaired by Paul Fesko, Manager of Strategic Services for the City of Calgary, representing Engineers Canada.

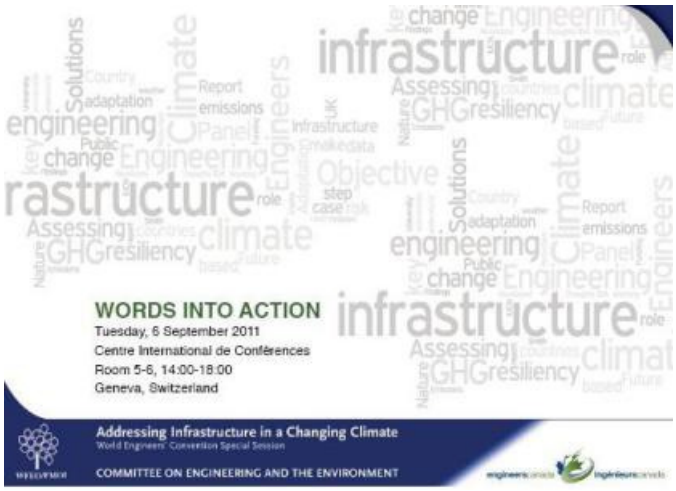
The session tied together two key infrastructure challenges for engineers in the 21st century. First, how can engineers adapt infrastructure to climate change and second, how can they reduce greenhouse gas emissions (mitigation) in the design and maintenance of infrastructure? The session demonstrated that both adaptation and mitigation are relevant to engineers and the future of engineering.

The session began by looking at the climate change challenge throughout the life cycle of infrastructure, particularly through the lens of the UK as The Royal Academy of Engineering released a report in February 2011 on ensuring infrastructure services in an uncertain future. This was followed by a panel with a practical example of assessing risk of infrastructure and prioritizing action in Latin America and how one bridges the climate science with infrastructure risk assessment processes. A second panel highlighted engineering solutions for greenhouse gas reduction based on the experience of 13 Engineering Associations from around the world as well as practical examples from the UK, one of the participating associations. The final keynote provided engineers with additional innovative solutions. It focused on nature as infrastructure leaving participants with both built and natural infrastructure options as a means to increase climate resiliency, reduce greenhouse gas emissions and meet developed and developing countries climate resiliency demands.

The chair helped weave a thread through the various speakers by having participants focus on the question: *How will preparing for climate change impact the future of engineering?*

Efforts were made to ensure participants got the most of the sessions as possible. For example, prior to the session, panellists met with the chair and each other, in order to prepare presentations that were clearly communicated, timely and supported the overall theme. Guidance was provided for presentation

development and delivery. In addition a graphic recorder was recruited to visually record the session. Studies show that visuals increase information retention and comprehension. As well, it created a real-time document that helped participants stay present in the moment and can be referred to in the future (see graphics below for each talk). Lastly, a variety of tactics were used to invite people to the session and share with those that could not be there. These included posting online via the wfeo.net website, email networks, using Twitter and distributing a 5x7 postcard on site at the WEC 2011 with session details. Words in the graphic describe the agenda posted on the backside of the card.

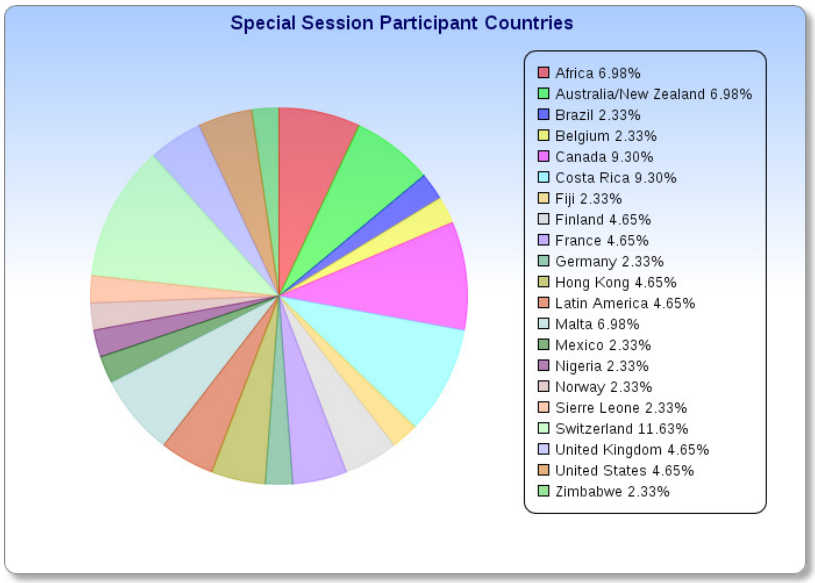


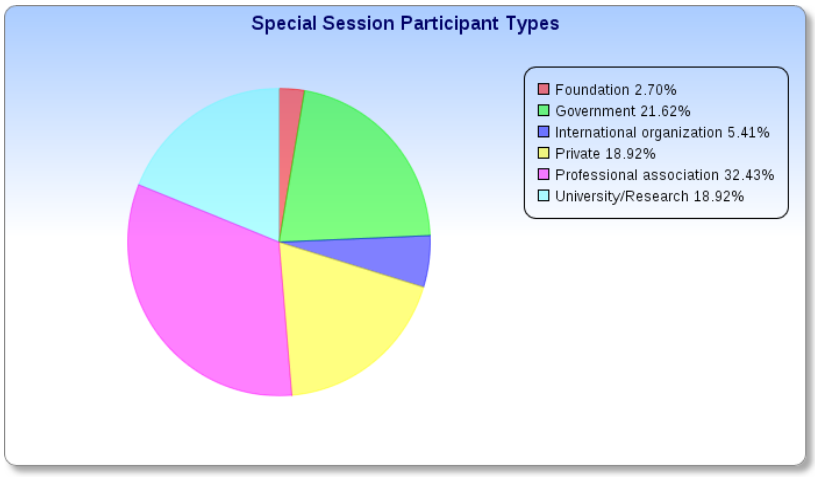
Session Facts

The session began with the chair encouraging participants to think about what they wanted to learn and to share those ideas with people sitting nearby. The room buzzed as people talked to each other. Participation was almost at capacity with approximately 80-90 people in the room.

Photo: Participants listening to Freddy Bolaños from Costa Rica.

From the information left by participants (40% left their business cards), we gather that a minimum of 20 countries were represented including a range of professions from universities and research institutes to governments, private enterprise and government institutions.





As noted above, the session was enhanced with a live graphic recording (images posted below) and live tweeting with the hashtag **#ccaction2011**. 24 tweets were sent out during the session itself and pre-tweeting and post-tweeting also took place. Here are a few examples of the tweets sharing out information during the session:

- David nickols says engage all stakeholders is the key to adapt and mitigate as engineering solutions part easy. #ccaction2011
- Freddy bolanos says PIEVC protocol is great planning tool and helps understand priorities at wec2011 #ccaction2011 @engineerscanada
- Heather auld compares climate model vs risk threshold approaches. Increasingly people use hybrid of approaches. #ccaction2011

- Frida frost reminds us that each country has different solutions for best technical pathway, there is more than one solution! #ccaction2011
- Daniel kenning gives 4 steps to success: team, influence, range of people, consensus. #ccaction2011
- Mark smith asks " what does natural infrastructure have to do with resilience to climate change?"#ccaction2011

Thank you to @engineerscanada, @wfeo and @iucnwater for helping share the information with your networks by re-tweeting several tweets during and after the session.

Keynote and Panel Presentations

An opening and closing keynote as well as two panels (including 4 presenters) stimulated ideas throughout the session. All presentations are posted and available for download on http://www.wfeo.net/.

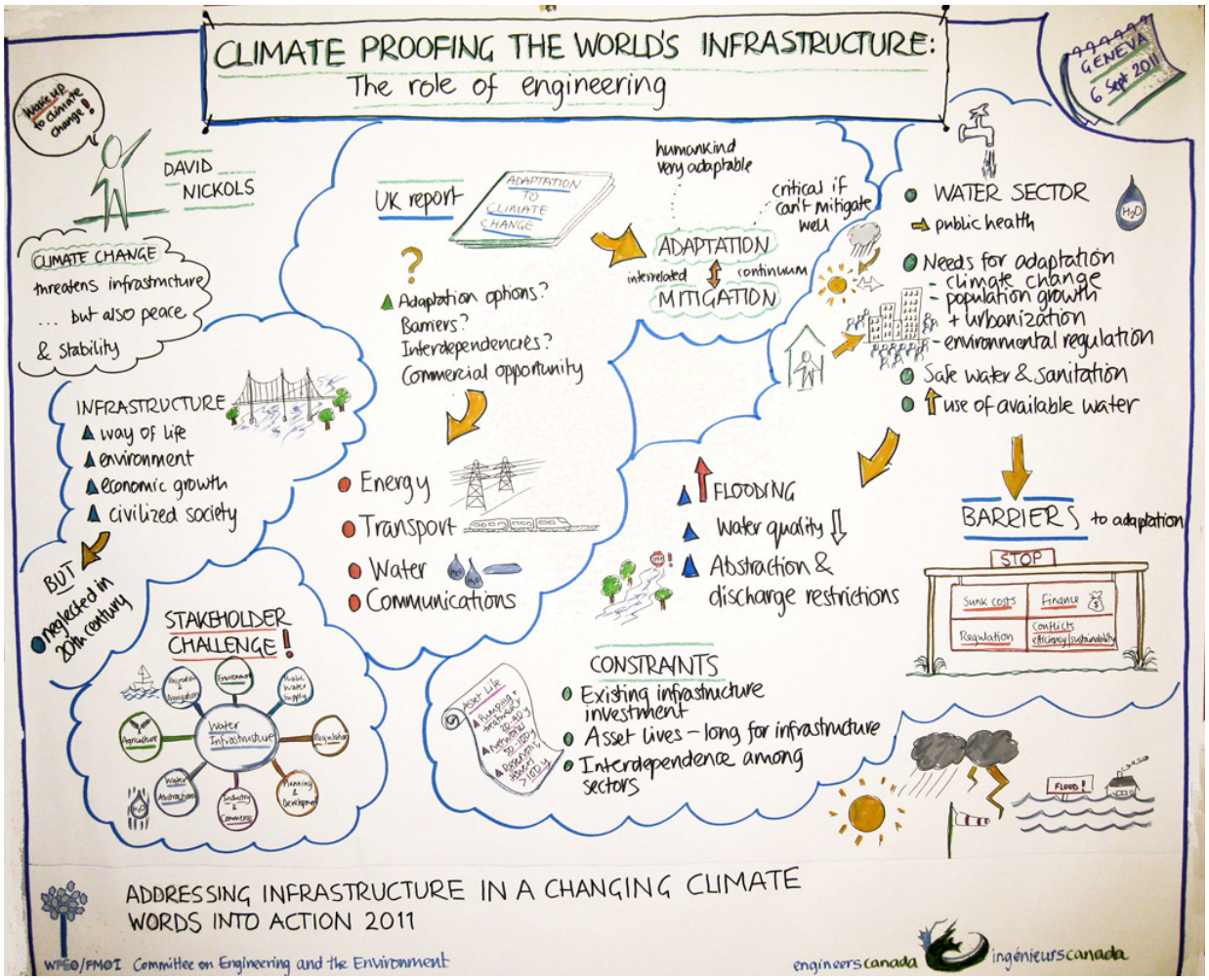
Photo of speakers (L to R): D.Nickols, F.Frost, M.Smith, H.Auld, F.Bolaños, D. Kenning

Below includes a graphic representation of each presentation along with a brief description of the talk and discussions. Graphic recording was done by Sarah Clark of Alchemy based in Lausanne, Switzerland. High resolution images are available on http://www.wfeo.net/.

The following points from the session chair highlight key messages from all the talks:

- There is a need to engage the engineering profession in solution building
- As science and engineering come together, how does one support the other?
- For mitigation, a lot of solutions require behaviour change and engaging beyond engineers
- Solutions aren't always technical or engineering based, i.e. engaging more stakeholders
- Overall, we need engineering working in partnership with other groups that we normally don't deal with to come up with solutions

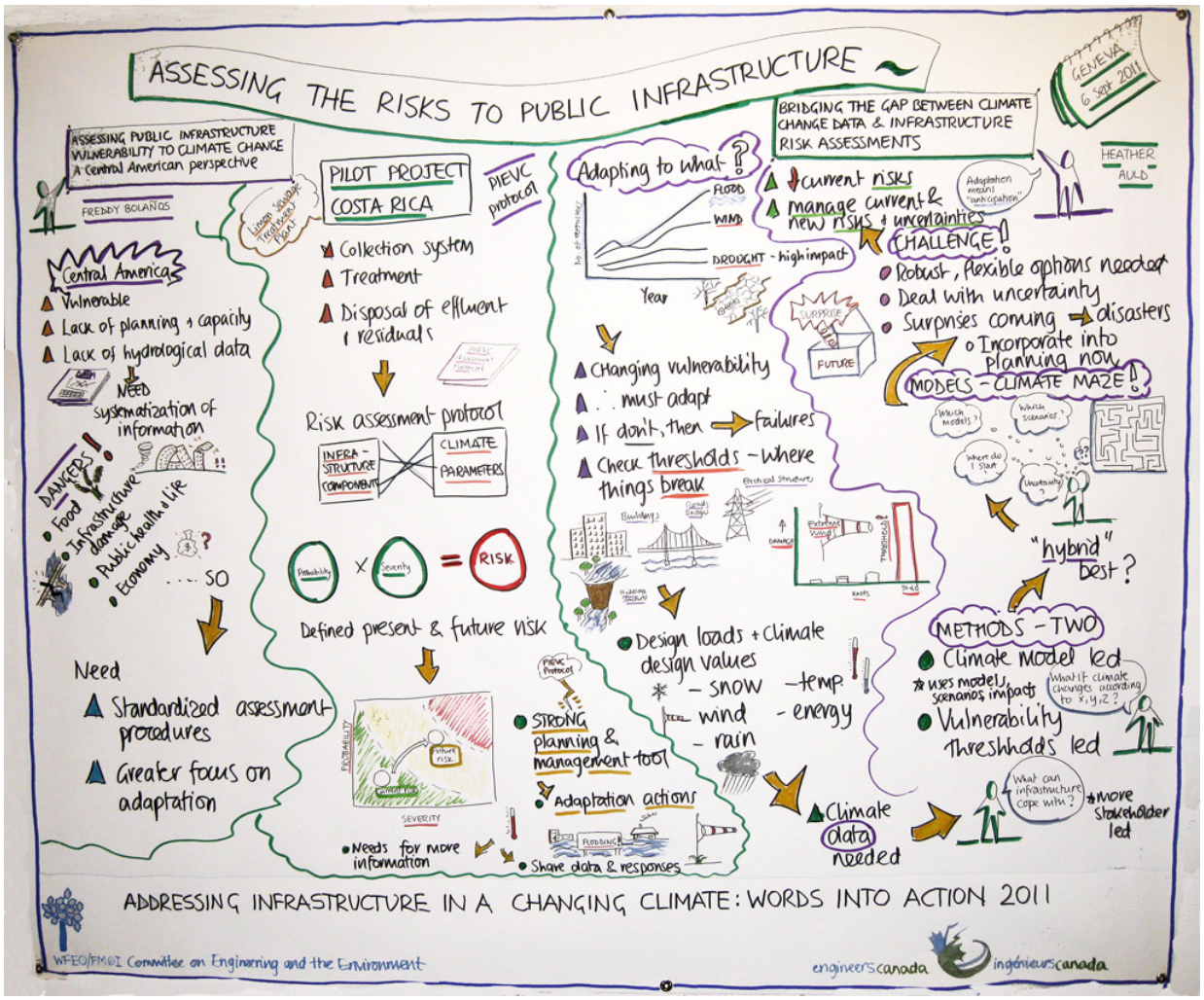
Opening Keynote: David Nickols, Chair, Expert Panel for Water at the Institution of Civil Engineers, UK



Nickols spoke about the importance of infrastructure to our lives and the reliance on engineering skills to build and enhance infrastructure. He stressed that adaptation and mitigation cannot be separated and complex infrastructure systems need to be managed as a system, not as individual assets. He suggested that conservation and reduction at small scales is the best solution and requires regulation and acceptance rather than engineering investments.

Q&A summary
Understanding risk is very local and difficult to assess nationally. We are decades away from modeling a country and only a couple years away from modeling a particular asset. The UK report discussed in the presentation identified that we need to understand better all the interdependencies. A lot of growth is predicted in the UK and there is a need to prepare.

Panel 1: Assessing the Risks to Public Infrastructure with Freddy Bolaños, Colegio Federado de Ingenieros y de Arquitectos de Costa Rica and Heather Auld, Environment Canada.



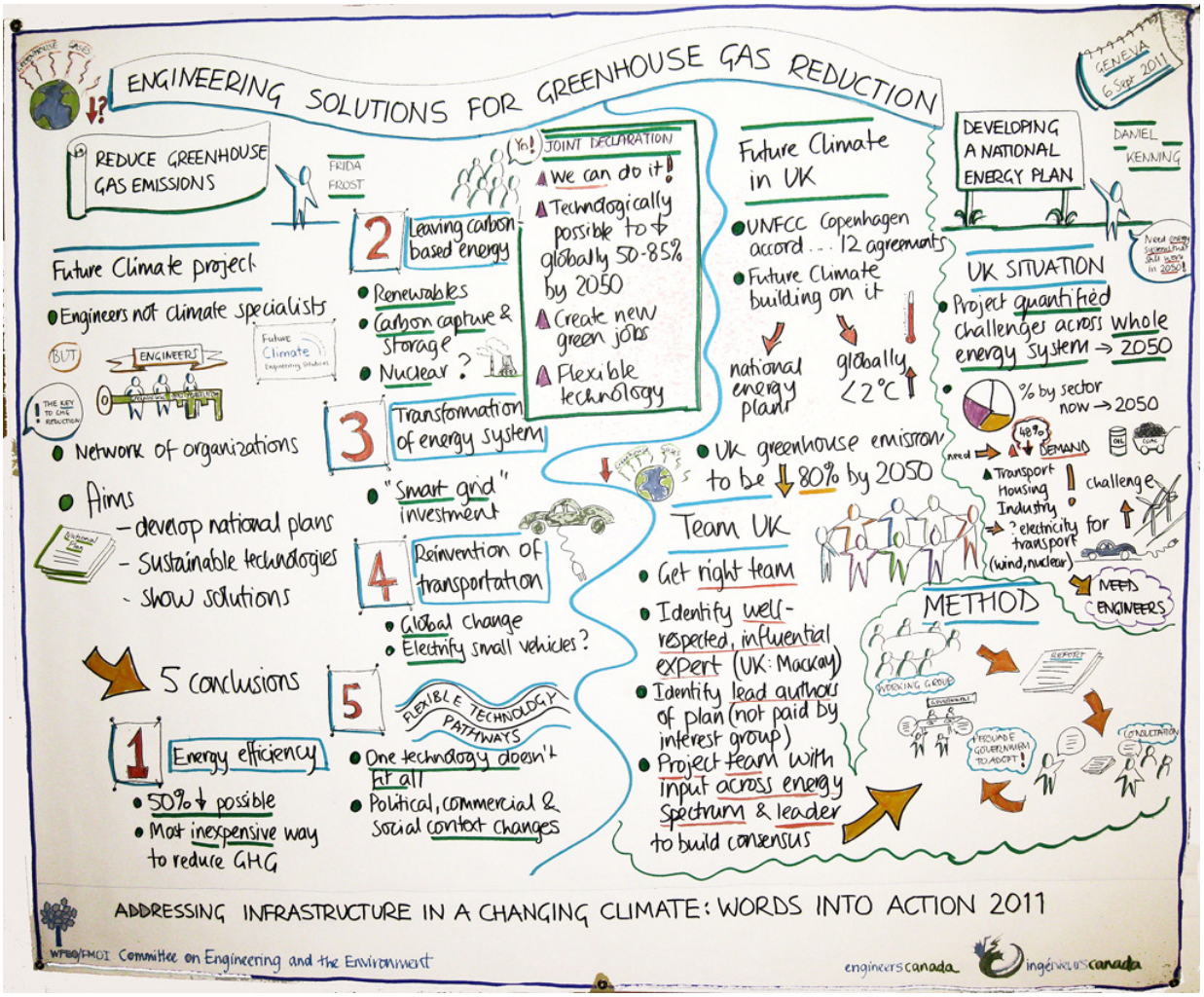
Bolaños highlighted that Central America is one of the most vulnerable regions in the world to climate change due to lack of planning and systematic information. The project in Limon, Costa Rica (using the PIEVC protocol, http://www.pievc.ca) helped to define the element within the infrastructure that will be affected by future climate and to what degree. It is a tool for planning and management and will be integrated into future projects in the city to help understand the system and prioritize risks.

Heather Auld focused on bridging the gap between climate change data and infrastructure risk assessments. She urged participants to anticipate what might come and what actions need to be taken. She recognized that there are many models available ("not all are equal") and there are tools coming out to help navigate this maze. The talk finished by encouraging people to look at no-regrets strategies and ways to deal with uncertainty.

Q&A Summary

Several comments and questions spoke to the fact that infrastructure was originally designed for certain loads and with climate change this load has increased. Assessment tools, such as the PIEVC protocol help to assess the increased capacity needed to handle the projected climate change. Regarding the level of detail in the output of the assessment process, panellists reminded people of the challenges of the process of bringing engineers and weather scientists together, short time frames and lack of information, which will impact the level of detail for outputs. Still, the process helps to prioritize and know where to start. Impacts will be different in different geographic locations and the best strategy is to be prepared by pinpointing areas that are most vulnerable. Participants asked about influencing politicians however in Costa Rica communication was successfully focused on operators and they are now integrating the methodology into other projects. It was noted that there are studies that illustrate the cost of not being prepared and the potential liability of not taking action is starting to have weight.

Panel 2: Engineering Solutions for GHG Reduction with Frida Frost, Danish Society of Engineers and Daniel Kenning, Institution of Mechanical Engineers in the UK



Frida Frost spoke to five ways to reduce GHG emissions based on the experience of 13 Engineering Associations from around the world. Findings are based on 'Future Climate - Engineering Solutions'.

This included reducing demand for energy, looking beyond nuclear and addressing transport systems. A key message is that there is more than one solution and we should consider our context and find the appropriate pathway.

Daniel Kenning provided practical examples from countries that participated in 'Future Climate – Engineering Solutions', particularly the UK. He spoke about the need to build the right team including respected individuals, identifying lead authors of the plans and a leader who builds consensus. It was suggested to focus on the people aspect such as consultation to ensure ownership and adoption of the plan. He noted the Future Climate Project quantifies energy consumption by sector in the present and in 2050 to determine how much reduction is needed and identify the challenge ahead. There is lots of work to do and funding is a challenge.

Q&A Summary

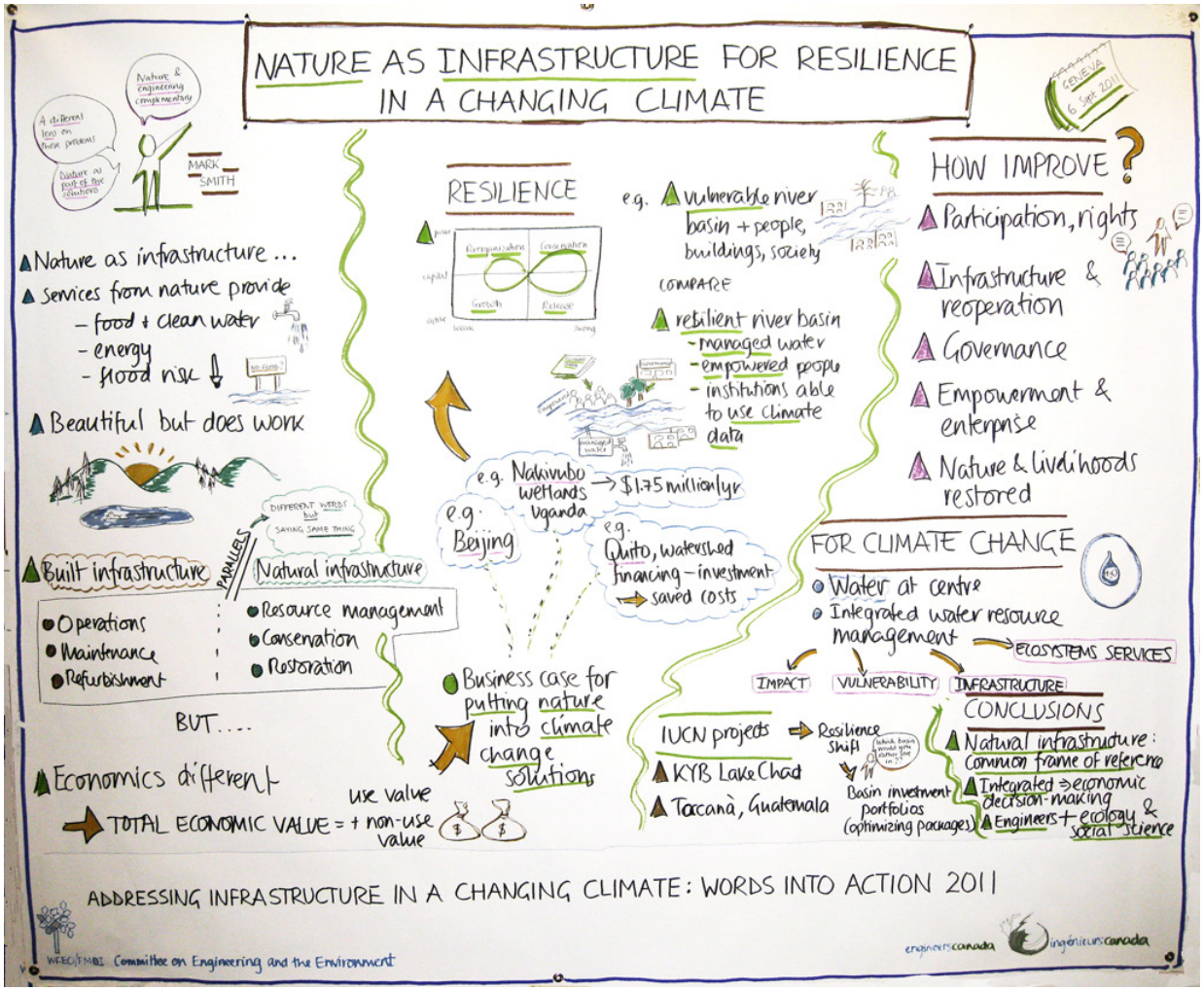
In getting started, barriers to overcome include funding, vested interests and political acceptance. It was suggested to use facts, impartial numbers and to hire a coordinator to organize and pull the information together. Knowledge and opportunities to get involved should be shared with less developed countries even if they aren't as dependent on fossil fuels as they also have solutions to offer though they may be different due to contexts. It was agreed that to make the suggested changes, everyone in the population needs to be involved and we need to start measuring energy so we quantify the changes. Finally, the education sector and professional associations can help by re-skilling engineers to solve the challenges.

Update on the Future Climate Project, Helping You to Create a National Energy Plan:

The second Future Climate Project took place in mid-September 2011 at the Institution of Mechanical Engineers in London and the 2011 version of the UK 2050 Energy Plan was published (www.imeche.org/knoweldge/policy).

The coordination of the Future Climate Project has been handed over from the Danish Society of Engineers (IDA) to the Cambridge University Engineering Department in the UK. You are invited to engage with the Future Climate project to support development of your own National Energy Plan. Contact us by email: dkenning@splendidengineering.co.uk or alison@cookeassociates.com

Closing keynote: Mark Smith, Director Global Water Programme, International Union for the Conservation of Nature (IUCN)



Dr. Smith concluded the session with rethinking infrastructure to include nature as part of the solutions, for example, water storage, conveyance and protection of coasts by nature. Natural infrastructure requires good governance, different knowledge and capacity as it marries bottom up with top down hence it needs different types of investment than the built environment. Several examples were provided demonstrating investments in resource management that saved costs downstream and he asked the question what do people need to become more resilient to climate change? Engineering solutions and behaviour change are needed.

Q&A Summary
Tools exist, including cost-benefit analysis, to rationally assess the impacts of dams in basins given potential negative impacts on people and communities and IUCN would like to see these used as a standard. For example, if you can manage flooding and sedimentation, new dams or additions to existing dams may be more viable. Frameworks should include social equity concerns.

Conclusions and Recommendations

'*Addressing Infrastructure in a Changing Climate'* was successful in bringing more than ninety people from around the world together to learn about how preparing for climate change will impact the future of engineering.

A variety of techniques to engage participants before and during the session were used including, invitation cards, website, keynotes, panels, tweeting and graphic recording. This is important for reaching out to different groups and sectors and should be enhanced for the future. More work is needed in identifying key audiences and improving dissemination tactics of communication materials leading up to events. Utilizing speaker networks should be considered in future events.

Future sessions should build on the main themes that came out of all the talks such as working in partnership across sectors, the inter-relationship between science and engineering and engaging stakeholders or 'non-engineering' solutions.

Ideas to help implement the main themes mentioned above include linking with other sectors by participating in their conferences (those that engineers normally don't go to) and inviting them to participate in engineering sessions hosted by Engineers Canada and/or WFEO-CEE. This was partially achieved through the diversity of panellists and speakers at the session and increasing this in future will help bridge the knowledge gap, as well as the culture gap between engineers and other sectors. In addition, increasing the time for sessions, for example from three hours to one day, would allow more opportunity for conversations, networking and knowledge sharing between participants.

Future sessions could aim to facilitate the emergence of new ideas and directions, i.e. working beyond silos, via participants/attendees in addition to focusing on delivery of information via speaker presentations. Using a diversity of meeting and workshop techniques within the session to deliver information as well as facilitate dialogue and solution building is recommended.

Lastly, reaching out across sectors will require investment of time and effort into communications and partnership building with individuals as well as institutions. Given the presence of social networking, 400 million users on Facebook and 50 million tweets per day, social media use should be enhanced and integrated into all outreach strategies within and across networks.