Session's Report

Title of the Session:	**Water, Food and Energy Nexus**
Chair:	
Moderator:	Anna Grichting Solder, PhD, Senior Fellow University of Vermont, Bordermeetings Switzerland
Introduction of the Session's topic:	Water, energy and food are necessary for the benefit of human well-being, poverty reduction and sustainable development. Improved water, energy, and food security on a global level can be achieved through a nexus approach—an approach that integrates management and governance across sectors and scales. This panel on the Food Water Energy nexus gathered speakers from different sectors - Academia, Government and NGOs, discussing the Nexus at multiple scales, from micro-nutrients, to community projects, university campuses and large watersheds, and in different cultural and political contexts, including Oman, Qatar, Iran and war torn Yemen. As an introduction, Anna Grichting presented a practical application through the Nexus through Urban Design on a University Campus entitled "The University as a microcosm of the City. Qatar University Living Laboratory for the Food Water Energy Nexus"

Panelist:	Bahram Taheri, PhD, Director at Nexus & HSE Center, Amirkabir University Technology Park, Iran
Title of the presentation:	Food Water Energy nexus. Systems thinking and cognitive gaps.
Outline/ Issues addressed:	NEXUS is an old Latin word which refers to the intricate interconnection of things and refers to a "System of Systems (SOS)" in which each subsystem and its elements, acquire additional qualities or capabilities that they did not possess on their own alone. It refers to the paired, tripled or multilateral interconnections/interactions between and among subsystems. The concept of circularity is an important aspect and application of nexus thinking, as are the concepts of Virtual water and embedded water.
Key-Takeaways:	Necessity to discuss the current status of nexus policy development and nexus solutions. We need to understand the subject of "wicked problems" and the relationship with nexus thinking. The role of digitalization and IOT within the system of systems approach and the nexus framework.

Panelist:	Muna Luqman, Founder & Co Founder, Food4Humanity & Women in Solidarity Network, Yemen.
Title of the presentation:	Water Food and Energy Nexus – Local Approaches
Outline/ Issues addressed:	The current dramatic levels of food insecurity in Yemen and the threat of famine are the results of over 8 years of war, adding to the already high levels existing pre-war. Yemen faces environment-related threats to human security, such as displacement, epidemics, and food insecurity; and this is fueled

	by the conflict, particularly the mass displacement of women and young girls, which also leads to conflict-related gender-based violence Food4humanity provides lifesaving emergency aid, clean water, education, women's protection and medical care to thousands of families in Yemen affected by violent conflict, climate change This multilevel approach has resulted in: •Resilience, peacebuilding and recovery •Empowering local communities through water initiatives (Water4peace) •Fostering social cohesion between the fragmented society
Key-Takeaways:	Food4Humanity is a practical application of local nexus implementation to provide food, water and energy to local communities in conflict situations. The importance of listening to civil society to find and build the best and most resilient solutions. Ressources are the most important area and roots of conflict We need much more awareness on the ground Practicle examples of renovating water stations, solar energy, resilience of local solutions, role of civil society

Panelist:	Hamed Al Dhalili, PhD, Ministry of Agriculture, Fisheries and Water Resources, Oman.
Title of the presentation:	Water Management Challenges for Agricultural Production in Oman
Outline/ Issues addressed:	One of the main problems of irrigation water in Oman is Agriculture which depletes the largest amount of water accounting for 83% of total consumption. Usage of traditional irrigation methods (80% flooding – 20% modern irrigation) with a low system efficiency and a big loss of water transferring and distributing. In many areas water demand exceeds supply and this draws saline water in to the aquifers. The Key Challenges could be classified as: Natural and environmental challenges, Economic challenges, Social challenges and Institutional and administrative challenge
Key-Takeaways:	The importance of collaborating with researchers, NGOs, private sector and civil society to find sustainable solutions for water management and the challenges that Oman is facing. The importance of integrating traditional methods and new technologies and research.

Panelist:	Jumana Saleh, Professor, Sultan Qaboos University, Oman.
Title of the presentation:	Magnesium: The Healing Gemstone of the Omani Coast
Outline/ Issues addressed:	During modern times, dietary calcium has become highly abundant, however, magnesium has become increasingly deficient as a result of modern agricultural, water purification and desalination practices Therefore drinking water and dietary sources have become magnesium deficient. On the other hand, sea water has three times more magnesium than calcium, and exceeds all sea minerals except sodium chloride. Oman is blessed

	with a vast coastal stretch along sea water that keeps this precious mineral within reach. Thus, swimming in seawater, and creating open seawater pools maximizes the benefits of this precious mineral, including vitamin D from the abundant sunshine in Oman
Key-Takeaways:	The importance of micronutrients in our health and their presence in water and soil. Simple and natural solutions to absorbing sufficient magnesium through sea water bathing and proposing sea water pools, as opposed to supplements which are not easily assimilated.

Panelist:	Talal Al Awadhi, Head of Geography Department, Sultan Qaboos University, Oman. GIS. Meshal Abdullah, Ph.D, Assistant Professor, Geography Department, Sultan Qaboos University, Muscat, Oman And Adjunct Research Assistant Professor, Department of Ecosystem Science and Management, Texas A&M University, USA.
Title of the presentation:	Water Sustainability, Food Security & GIS Technologies.
Outline/ Issues addressed:	This research presents Potential Strategies using GIS and nexus thinking to optimize water efficiency and use. One potential strategy to simultaneously achieve higher food security and water sustainability is to optimally use Ecosystem Services of the arid and semiarid ecosystems. Grazing is one of the essential ecosystem services that may enhance food and water security by reducing the water consumption for fodder production. The steady increase in fodder production is partially attributed to land degradation, which deprives the natural ecosystems of its critical services such as grazing. Understanding the physical characteristics of the water streams is critical as it could help determine high-risk areas for future cyclones and support decision-makers in developing proper risk management programs.
Key-Takeaways:	To develop an integrative method using Remote Sensing and GIS to understand the role of the physical characteristics of the streams during Shaheen cyclone. Continue developing quantitative characterization Nexus models to understand the interlinkages and tradeoffs between the natural ecosystems and agro-agriculture systems using advance remote sensing techniques including UAVs.

Issues raised during discussions with audience	Question from Dr. Abdulla Al-Ghafri on the management of the Aflaj traditional water systems raised important issues on managing common ressources, and how we can learn from, and and bridge, technology and tradition, while modernizing and adapting to contemporary and future situations. Some additional questions: What are the main aspects of Yemen's Food, water and energy crisis? How do they interlink with the ongoing conflict? What is the relation between

	addressing the nexus and peacemaking and are there any other examples from Yemen? Have any local studies of the effect of magnesium on health been performed ? Are people aware of the benefits of sea bathing or walking in sea water?
Conclusions of the session	The session highlighted the complexity of addressing these "wicked" problems of systems and nexus thinking, and how our education and governance systems need to adapt to remove barriers and silos . GIS and modelling tools can assist to integrate complex data and envision scenarios for more efficient management of ressources, and collaboration between the academic researchers with the government ministeries managing food water and energy ressources is important to develop new and practical solutions. The nexus solutions must also address the quality, and not just the quantity of ressources, be it water or food, as these have an important impact on human and ecosystem health. Sea water should also be considered a water resource for its benefits of minerals (magnesium) and production of halophytes and sea water pools could both save fresh water and provide much needed minerals. Practical examples in Yemen demonstrate the effectiveness and resilience of community led projects to address food, water and energy shortages and how they can improve the livelihoods and education of the population, especially women and youth. Finally discussions on creating a Living Laboratory for the Food Water Energy Nexus at Sultan Qaboos University could be a way to engage multiple stakeholders on a practical project and physical site.