

Summary Report

**“The Future of
Global Energy Security
in the Age of Digitalization”**

International Workshop in Singapore

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Event Summary

The increasingly prominent trend of digitalization in the global energy sector has led to various changes as well as a large number of challenges, including global energy security. As one of the mutually enhancing strategic factors, digitalization, together with decarbonisation and decentralization ('3 Ds') has great potential to contribute to the shift to a non-fossil fuel energy system. The interaction between digitalization and energy security is multifaceted, which merits contemplation from a multidisciplinary perspective. The KAS International Conference on "The Future of Global Energy Security in the Age of Digitalization" is divided into welcoming remarks, introduction, keynote speech, three sessions (Session 1: Global Energy Megatrends: from Scarcity to Abundance; Session 2: Rising New Cyber Security Threats:



In the welcoming remarks, [Dr Peter Hefele](#) laid down the fundamental framework of this conference and highlighted the importance of the theme from a wide range of perspectives, including technology, economics and geopolitics. This shed light on the major focus of following sessions and discussions. Dr Tim Philippi referred to the liberalization and diversification of Singapore's energy market as an illustrative example. He also pointed out that digitalization will bring new technologies and opportunities to enhance energy efficiency and energy security in Singapore.

During the introduction [Dr Frank Umbach](#), gave a comprehensive elaboration on his publication funded by KAS, which illustrates how energy security evolves under the context of a digitalized world and its geopolitical implications. Energy security, the definition of which has been evolving, includes sustainability, supply security and economic competitiveness. A digitalized global energy system is bound to generate profound geopolitical implications. These implications include the intensified competition for the best and most disruptive techno-

Protecting Critical Energy Infrastructure; Session 3: Digitalization and Decarbonisation: Coping with Disruptive Developments) and one roundtable discussion.

logies, access to critical raw materials, as well as rising cyber security vulnerabilities and threats to critical infrastructures. Ambassador Yong, in the keynote speech focused on Singapore and other ASEAN countries' geopolitical challenges, particularly with respect to environmental issues, such as plastic pollution and energy demand.



In Session 1, [Mr. Michael Williamson](#) started with a brief introduction of energy history, which is featured with a shift from golden age in the 1950s to oil crisis in the 1970s and climate crisis in 2010s. At the current stage, various supports, namely, technological acceleration and non-energy companies' participation have fuelled this energy development; however, more political supports are still needed for the transition to a sustainable energy system. He also pointed out the obstacles to the realization of renewable energy abundance, which include financial constraints, long distance transmission interconnection, sovereign risks and others. Questions on how to solve these problems represent a big challenge, but also a great opportunity for

the world to achieve abundance in energy within the next decades.



[Dr Jiang Kejun](#) discussed the relationship between energy transition and oil demand in China. The air pollution, reflected by PM2.5 indicator in China has become increasingly severe in recent years. At the same time, China faces the imperative to mitigate climate change while meeting the energy demand. Therefore, China needs to realize a rapid transition to clean energy-based system. There are four streams of actions: energy revolution, renewable energy development policy package, energy reforming and clean air action plan. This also could contribute to achieving Sustainable Development Goals 2, 3, 6, 7, 8 and 13 simultaneously.

[Dr Daniel Scholten](#) analysed the geopolitical implications of a transition to renewable energy in a comprehensive manner.

As a positive disruption, renewable energy development alleviates existing challenges but also bring new ones, such as grid politics, asset ownership.

How the international community could facilitate a smooth global transition to a fast, stable and inclusive energy system becomes significant.

Mr. Philipp Offenberg gave a presentation concerning European cyber security policy. Starting from the early 2000s, the EU has been involved in policy-making of controlling cyber security and energy security by establishing relevant institution and crafting strategies. Climate action and energy policies constitute key part of Europe's modernization agenda, which at the same time implicates Europe's security. As one of the most likely risks, cyber threats present challenges to the EU citizens and the economy as a whole. Particularly in energy sector, a number of key challenges in terms of cyber security exist, which are: real time requirements, cascading effects and legacy technologies connected to digital technologies. In 2017, the EU has created a cybersecurity package with the aim to enhance the resilience to cyberattacks. Specific actions also have been taken to address cybersecurity in energy sector, such as improving cybersecurity guidance, establishing network code and early warning systems for cyber threats and cross-border risk management.

Dr Marcus Eul elaborated on how to protect critical energy infrastructure in the face of rising new cyber security threats. Cyber risks are growing with respect to their sophistication and the frequency of emergence. The economic and physical consequences of cyberattacks on energy infrastructure could be severe. The rapidly changing energy world is one of the drivers of the increasing vulnerability to cyberattacks. In addition, the new energy market is featured with many decentralized sites and localized grouping of electricity sources which connect local prosumers with the traditional centralized electrical grid, which makes it an easier target of cyberattacks. In this vein, the governments need to make efforts to improve cybersecurity and address cyberattacks. For example, the German government has introduced a mandatory reporting procedure for IT security incidents at operator of critical infrastructure and implemented minimal security standards for critical infrastructure in sectors, such as energy, water, and telecommunications.

Mr. Can Ogutcu discussed how to cope with disruptive forces and trends in the energy sector by governments and private sectors under the context of digitalization and decarbonisation. It is undisputed that oil and gas would continue to feature prominently in energy mix in the forthcoming years. However, factors such as government policy, demographic change, economic growth, changing consumer behaviour and climate change would influence the energy mix and make prediction on future energy demand rather difficult. Entering the new age for energy, private sectors need to develop different business models so as to



compete and create a niche in the new energy landscape that is premised on technology and innovation.

Mr. Naoki Toda referred to the development of utility in Japan by introducing the concept of Utility 3.0, which is a vision of utility for the future. Five drivers as well as major trends in Utility 3.0 are: decentralization, decarbonisation, deregulation, digitalization and depopulation, which could improve productivity and provide new values.

aches: slimming down facilities, re-balancing the T&D rate structure, enabling smart operation and maintenance and integration with other infrastructure.

Dr Daniel Quiggin discussed the role of utilities as energy services with respect to digital fragmentation. The new phase of transformations in the power sector would witness the intensified competition for flexibility in electricity system, which unfortunately existing companies are not well prepared for. Therefore, companies that are capable of providing solutions to enhance electricity system flexibility could likely dominate the sector in the coming decades. The Phase One transformation has been fuelled by market reform, energy efficiency increase and renewable energy development. Utilities in this stage have three options, namely to leave, to entrench and to transform. When it comes to the Phase Two transformation, the system flexibility becomes more important because it can reduce the cost of system integration. Technological advance plays a positive role in enhancing the flexibility while digitalization is the heart, which explains the substantial investment in digital infrastructure and software around the world. Nevertheless, digitally enabled flexibility threatens the traditional role of utilities supplying power. Utilities need to shift their mind-set from owning capital intensive generation infrastructure to engaging in new infrastructure light business models, platforms and providing new services.

Decentralization leads to exponential price destruction and growth of distributed energy resources and energy storage. This means electricity would get a competitive advantage among the whole energy mix. Although current power market has not introduced such power plants in Japan, the breakthrough point will come at some time until 2050. At the same time, the mega trends will bring challenges, such as decline in electricity facility utilization, the demand for increased sophistication in the distribution network. There are a number of appro-

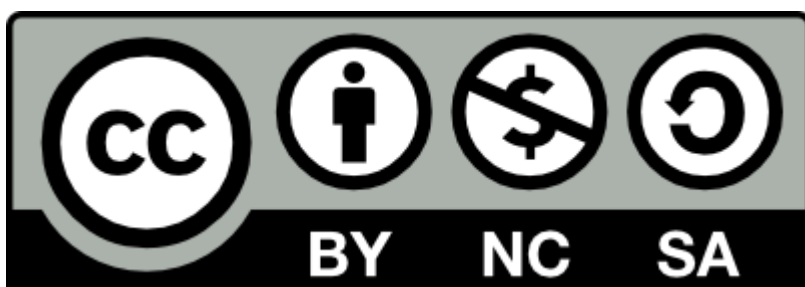


Dr Sanjay Kuttan elaborated on how to cope with disruption from digitalization and decarbonisation given that the energy and utility sector is highly vulnerable to future disruptions, particularly during the very early stage. Forces like electricity markets, technology advances, convergence, demand side management, green consciousness, and prosumer could disrupt the power sector. How to improve efficiency, performance and innovation is of great importance in reducing the energy sector's vulnerability to future disruption. Technology, policy, standards, financing and manpower constitute major drivers to enabling digital utility. As a critical part of digitalization of the energy landscape, a secure and intelligent central energy management system needs to be established. It is time for the energy and utility to take into account possible changes and engage in innovation through design thinking so as to cope with future disruptions.

The panel discussion focused on the future of global energy in the age of digitalization from the perspectives of technology, governance and economics. Mr. Mathias Steck chaired the panel by introducing the theme: internet of energy. The old time energy infrastructure was simple and straightforward while internet of things (IoT) will push for the revolution of the energy ecosystem. This could put end user in the centre of the energy system and renders services instead of resources valuable. The following decade would witness the transformation from smart grid to a soft grid, in which these who offer the best application and data analytics will be winner.



The publication is available on <http://www.kas.de/recap/en/publications/53447/>



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