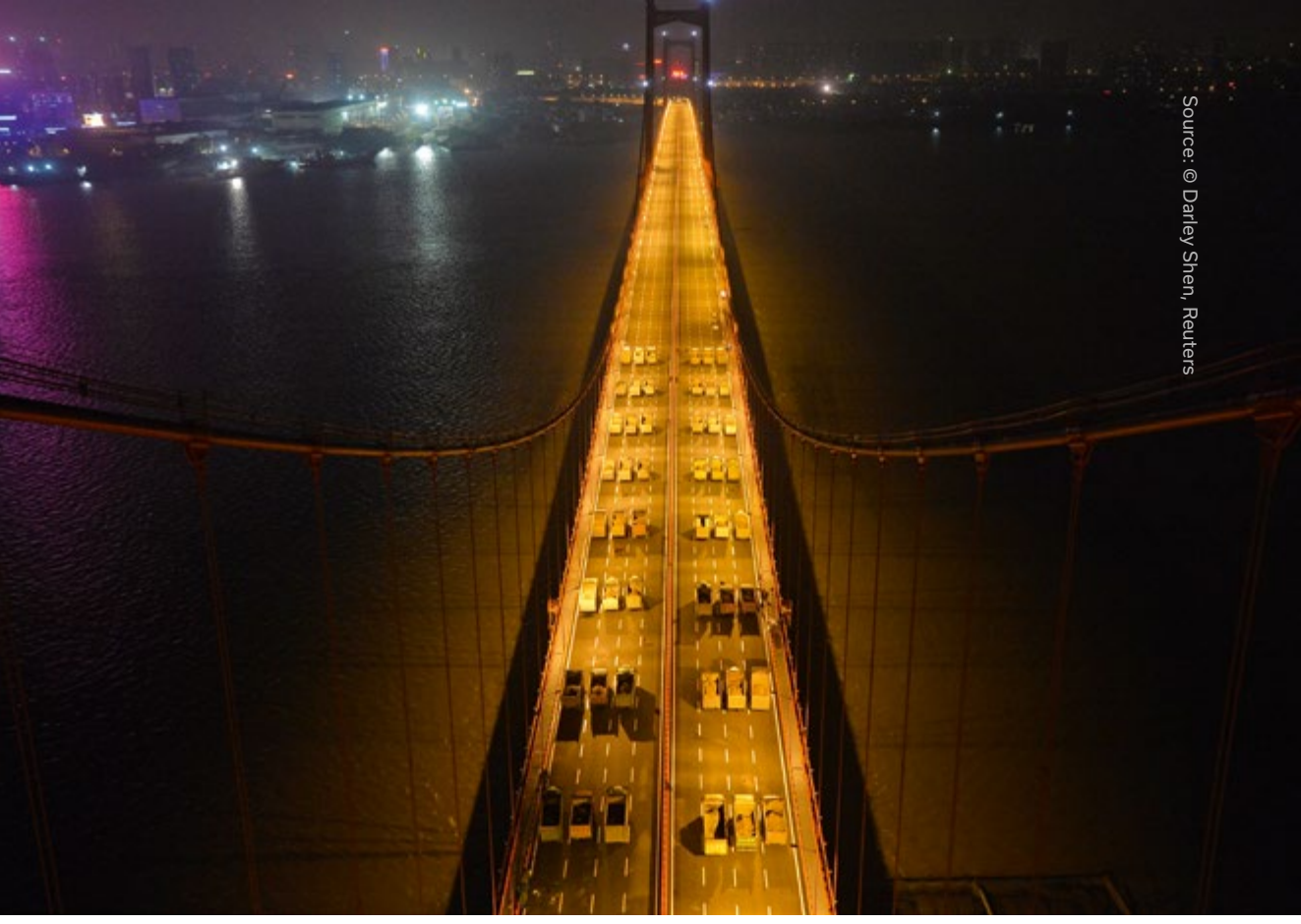

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The Digital Future

Of Streams of Data, Thought, and Other Things

Digitalisation, Energy Policy, and Innovation Capacity From an Asian Perspective

Peter Hefele

What influence do digitalisation processes have on the use of energy and raw materials? What innovation dynamics result from the potential, still far from exhausted, of these developments? And what influence does all this have on the geoeconomic and geopolitical interrelationships in the international system? This article addresses these questions from an Asian perspective.

Big Data, Industry 4.0, Smart Cities – digitalisation is seen all over the world as *the* silver bullet for innovations in politics, business, and society. This is also particularly true of the fast-growing, often still very young societies in the Asia-Pacific region. Optimism about progress, enthusiasm for technology, and joy of experimentation create a unique digital ecosystem here, one which eagerly embraces innovations and creates rapidly growing markets with extremely high competitive pressure for companies. But beyond the everyday world of *WeChat*, *Line*, *Viber*, and *Alipay*, dramatic upheavals in traditional value-added chains are looming in the course of the ongoing digitalisation process. These, in turn, are connected to tectonic shifts of the geopolitical and geoeconomic map. And the centre of all this is access to and use of energy and raw materials, as it has been many times before throughout history. The significance of the correlation between these developments and rapidly progressing digitalisation processes has not yet been fully understood, let alone politically managed. Usually, only isolated processes, services, and products are taken into consideration. What is much more decisive, however, are the dynamics of innovation that digitalisation can trigger and that, for the most part, can only be adequately understood within a larger system context.

This article will therefore examine questions of future energy and the use of resources in more detail, focusing on its interactions with digitalisation processes and their innovation potential. It will address technologies and innovations beyond the strictly technical aspects. This is because social and political innovations that are triggered by digitalisation, but that digitalisation can also (in the best case) regulate, are far more significant. Ultimately, this is about building institutions and shaping change processes by political means.

Three important development axes of future digitised energy and resource systems will be presented in light of their respective effects on geopolitics, the (global) energy industry, and (global) society. They not only affect the Asia-Pacific region, but also fundamentally call into question the prerequisites of our prosperity and the power of Germany and Europe to shape policy. In concrete terms, this concerns

1. geopolitical shifts in power,
2. the transformation of energy systems, especially in urban areas, and
3. the opportunities and risks inherent in a far-reaching digitalised energy industry.

Starting Situation

First, some essential characteristics of the existing global energy and raw materials system will be discussed in order to gain a reference point for the dynamics and possible direction of movement of the current changes.

After a brief euphoria at the end of the Cold War, the liberal world order created at the end of the Second World War is now being eroded to an unprecedented degree. What is often forgotten is that this world order, commonly referred to as *pax americana*, was essentially also a world

energy order. Its main features were established as early as the 1920s, but it did not come into full effect until after the Second World War and was based almost exclusively on a specific production and distribution regime for fossil hydrocarbons, especially oil and gas. The importance of free markets was always emphasised in the energy policy debate at the time, but this tended to be an ideological smokescreen given the oligopolies and cartels on the energy markets.

The world order that is commonly referred to as *pax americana* was primarily a world *energy* order.

It is therefore not surprising that the current geopolitical upheavals – greater than those in virtually any other field – are emerging primarily in the global energy and raw materials markets. The latter are now the focus of all major regional and geopolitical actors' (geo-)political, economic, and military strategies. Energy and raw materials have become key issues in the global public discourse. Whereas the importance of market processes used to dominate, it is now becoming increasingly common to speak of a "securitisation" of raw materials – energy and raw materials as essential sources and instruments of national power (projections). Many therefore view the great game as being not only back in Central Asia, rich as it is in energy and raw materials. Unfortunately, these processes often go hand in hand with an autocratisation of political systems, where several factors play a role: for example, the monopolisation of political *and* economic resources in the hands of small elites in response to resource bottlenecks, or as a basis for legitimacy for (real or artificially created) intra- and interstate conflicts.

However, contradictory developments can also be found in the energy markets themselves, where phenomena of abundance and scarcity often occur in a direct local and / or temporal context. It is not without good reason there has been a move away from placing the finite nature of fossil fuels and raw materials (oil peak) in the foreground of discussions about energy policy over the last few years. From a global perspective, no serious bottlenecks are likely to arise in the foreseeable future, either in terms of available quantities or price trends. The local and technological diversification of sources of supply and the hedging of risks through financial market instruments and government regulation – to name but a few mechanisms – are at a very high level worldwide; a development to which the experience of the oil crisis of the 1970s certainly contributed. In short, national and global energy and raw material systems are more resistant to shocks than the general public often assumes it to be.

However, shortages and conflictual developments threaten energy and raw material systems elsewhere. This is where innovations must come into play to an unprecedented degree: in intelligently using fossil-based economies and production methods and dealing with their consequences, avoiding and coping with the consequences of climate change, combatting social inequalities, distortions, as well as political instability and the autocratisation of political systems.

Against the backdrop of these developments, which often give little cause for optimism, it is therefore important to look for the causes, justifications, and driving forces behind innovations and innovation dynamics. And to ask ourselves what kind of innovations they might be and what role digitalisation plays, and ultimately how and under what conditions such innovations could be created.

Geopolitical Market and Power Shifts

Renewable energies are increasingly proving to be disruptive technologies and are changing value-added processes, which will challenge the existing structure of entire economies. Yet these effects also apply to newer, low-emission forms of the extraction and use of fossil

and non-fossil hydrocarbons (such as liquid fuels derived from biomass or carbon capture, storage and utilisation, CCSU). Those initially affected are traditional producer countries such as the Gulf States or Central Asian republics. However, "fossil" economic structures and established business models are coming under massive pressure to adapt in consumer countries as well. In many cases, producer countries and regions are already experiencing a critical "burden syndrome" which is exacerbated by the above-mentioned effects. A regionally and globally oriented security and development policy must proactively mitigate and hedge these massive distortions in the existing production countries and distribution systems; since it is highly unlikely that the negative effects can be avoided entirely. These efforts must include ensuring that there is fair access to resources, and that the negative environmental and climate impact be at the centre of a forward-looking international raw materials policy. To this end, the ability to make forecasts must be significantly improved at all decision-making levels (households, companies, nation states). Governments and companies should avoid being caught in so-called lock-in situations at all costs: one-sided dependencies on certain raw materials or customers. This does not happen when open and innovation-promoting standards and fair market conditions prevail. Regional and global consultation and coordination mechanisms must also be strengthened due to the considerable potential for conflict in security policy. It is in the core interest of Europe and Germany to shape and enforce them.

Renewable energies are increasingly proving to be disruptive technologies, challenging the structure of entire economies.

Energy Transformation and Urbanisation

Worldwide, the degree of urbanisation is currently around 55 per cent – and rising. This development will continue unabated over the next few decades, especially in the Asia-Pacific region, Africa, and Latin America. At the same time, urban energy demand is growing at a disproportionately high rate and already accounts for around 75 per cent of global energy consumption. In most cases, urbanisation proceeds largely unplanned. Today's dominant development patterns cement long-lasting dependencies on fossil fuels due to inadequate traffic planning, lack of energy efficiency in buildings, etc. At the same time, these spaces could represent a unique environment, serving as future laboratories. *Smart solutions* based on intelligent data collection and networking have enormous potential to increase energy and resource efficiency. In Asia in particular, however, there is a risk of misusing digitalisation as an instrument for comprehensive monitoring and behavioural control, in order to enforce apparently more efficient top-down decisions. This would and will massively restrict the diverse, decentralised, innovation-promoting opportunities for and by citizen participation in new technologies. More than any other type of space, cities offer opportunities for cross-sectoral policy approaches. They can provide examples for entire economies. Thus far, transformation processes have been too often carried out in "silos". The ambitious German energy revolution must also urgently promote intelligent networking (in both the physical and conceptual sense), in order to create the infrastructure for a new digital economy 2.0. At the same time, and especially in Asia, the required energy transformation cannot be limited to renewable energies. At present, there are no realistic scenarios that would suggest that the (dominating) role of fossil (and nuclear) energy sources will be abandoned in the next 50 years. Therefore, new solutions for security risks and emission avoidance have to be found. In this context, it is already becoming apparent that the importance of the production and use of primary raw

materials is in relative decline and that, in the course of circularisation and digitalisation, the intelligent use and recycling of raw materials will become key fields of economic value creation.

Digitalisation and Use of Energy and Resources

Both the analysis and the conceptual management of the effects of digitalisation on today's

energy and resource systems, are still in their infancy. Fears and hopes are often balanced, but all forecasts indicate that the risks, costs, and benefits of this upheaval will be very unevenly distributed. Key developments that will have a major impact on the energy policy landscape will be briefly outlined below.

Electrical energy as a share of total energy use will increase significantly over the next few decades. The pace of this increase will largely depend on progress in storage technologies and electromobility. From a technical point of view, electrical energy offers the highest potential for efficiency gains and cross-sectoral approaches. With regard to the necessary regional energy market integration (European Energy Union, ASEAN, Northeast Asia), electric grids will take centre stage.

This development cannot be imagined without *accelerated digitalisation* if we want to ensure scalability, maximum coverage, and further increasing shares of renewable energies and their decentralised use. However, this requires an appropriate regulatory framework that will primarily break the energy market monopoly structures that are still in place and open up new business models for small and medium-sized enterprises.

The digitalisation of networks and processes in the energy and infrastructure sector entails increased *vulnerability* to cyberattacks. However, the awareness and understanding of this type of threat is growing much slower than the technical capabilities of the attackers. Open standards, a shift in awareness among manufacturers and users, and cross-sectoral policy and action approaches are essential for effective hazard prevention.

As has been described, considerable social and political instability is to be expected in the course of shifts in demand and the devaluation of government and private assets (as a result of *decarbonisation strategies*, for example).

Disruptive technology: Renewable energies are changing value creation processes, calling into question the existing structure of whole economies. Source: © Marcelo del Pozo, Reuters.

"Transformation consultancy" for transforming economies and developing new business models, must be urgently pressed forward.

The *key role of critical and rare raw materials* is underestimated in many cases, both for digitalisation and the further increase in the share of renewable energies. It is precisely in this area that there are often extreme dependencies on a few suppliers, and the elimination of these dependencies must be pursued with some urgency. At the same time, a broad field of innovation with a view to substitution and more efficient material cycles (circular economy) is emerging here.

Germany as a Digital and Energy Policy Competence Centre

If we take a look at the challenges posed by digitalisation and the energy revolution – and only a few of them have been addressed in this article – we discover an astonishingly large number of classic topics in which Germany traditionally has great strengths and which can be updated or upgraded digitally. Here are three major fields of action:

Reforming and Opening up Markets and the Role of Small and Medium-Sized Enterprises as Innovators

The disruption of established markets means that new value chains must and can be created. This will create market niches for innovative companies in the course of digitalisation, since existing cost structures can be overcome more easily through a more cost-effective scaling of processes, for instance. In the energy sector, a considerable number of start-up companies have established themselves, offering new product and service portfolios such as smart metering, and thus challenging established suppliers. However, this potential can only be exploited if fair access conditions are met. Direct and indirect network effects (such as those associated with such market-dominant providers as Amazon or Microsoft) that often function as effective market entry barriers and require intelligent state regulation, should be considered in this context.

Role and Importance of Metropolises as Innovation Centres

Metropolises, functioning as nodes of globalisation, have established themselves as independent actors in global politics. Important ideas emanate from them, as international climate diplomacy has shown. Their role as laboratories of the future will be demonstrated not least in the Asia-Pacific region, where metropolitan areas will become the predominant type of settlement within the next two decades. However, they will be able to develop their innovation potential only if their autonomous political role in the state structure is strengthened and sufficient public participation opportunities for citizens are provided. Here, digitalisation opens up a wide range of options for data use and data networking, from intelligent energy and resource use to transparent public and private services geared towards individual needs.

The increasing danger of cyberattacks must be met with international legal regulations and multilateral conflict resolution.

The Importance of Regional Multilateral and Cooperative Security Architectures

The digitalisation of vital infrastructures, in the energy sector, for example, is already quite advanced. Increasingly frequent governmental and private cyberattacks reveal the vulnerability of these systems, and in many cases and for good reasons, can be seen as new forms of warfare with enormous potential for escalation. The development of international legal regulations and mechanisms of multilateral conflict avoidance and conflict resolution, has so far been entirely inadequate. Access to energy and raw materials (such as rare earths) has already been used several times as a means of exerting pressure between states.

Global energy systems are currently undergoing an epochal upheaval that is interacting with the digital revolution in many ways. Both developments offer Germany enormous innovation potential that goes far beyond technical solutions. Germany is in demand globally as a partner when it comes to complex challenges – be it in the creation of new value chains, in sustainable development strategies, or in regional conflict management.

–translated from German–

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