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cutting through complexity

KPMG GLOBAL ENERGY INSTITUTE EUROPE,
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Energy – Quo vadis?

2035Plus: Scenarios for tomorrow's energy sector

Executive summary

Contents

The study is structured according to these three phases of (scientific) foresight:

1. **Scanning**
   Environmental analysis and uncertainties
2. **Foresight**
   Scenarios, trends and wildcards
3. **Transfer**
   Implications and biases

Foreword

New forms of energy, a complex and constantly changing regulatory environment, and an ever-increasing need for investment: hardly any industry in the world is currently facing greater challenges than the energy sector. At the same time, however, there is some good news: these challenges also present the energy industry with a unique opportunity. History has shown that crises can actually force the pace of innovation by creating and driving the need for strategic creativity.

Such phases of uncertainty also have advantages. Times of change are usually also times of innovation. As a glance in the past reveals, crises can actually spark creativity due to required rethinking. Some of the greatest business innovations of modern times originated in the midst of great turbulence – this applies to approximately half of the Fortune 500 companies, including trendsetters like Microsoft and Google. Seen from this perspective, the current "crisis" could actually mean that a game-changing opportunity for the energy sector is just around the corner, waiting to be seized.

In this sense, the study "Energy – Quo Vadis?" aims to support decision-makers in the industry in sustainably exploiting various opportunities. For this purpose, we utilised a variety of futurology methods to identify scenarios, wildcards, roadmaps, interesting innovations, visions and current trends. This extensive information assists in intensely analysing and anticipating the challenges and opportunities of the future.

This executive summary provides a brief but comprehensive overview of the main issues covered and conclusions from the study. Each of the key issues is dealt with in more detail in our complete study, "Energy – Quo Vadis?".

We hope you enjoy these challenging and stimulating insights into the possible energy world of the future. And we look forward to continuing the discussion with you.

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Why This Study?

Why is futurology so important for the energy sector?

"Every generation needs a new revolution."
Thomas Jefferson, 3rd President of the USA

The energy sector is characterised by the complex interaction of numerous factors. The scenarios method has proven to be particularly well suited in analysing and managing such an unclear environment. This instrument for strategic forecasting enables potential future developments to be analysed and causal connections to be illustrated. Thereby, hypothetical consequences of events are depicted in the form of various scenarios to draw attention to important processes and key decision moments. Although this method was originally used by the military, it was recognised decades ago that it can be applied in many fields with complex environments, such as the energy sector. Therefore, the plethora of scenario studies in this sector is hardly surprising. Why do we think an additional scenario study is necessary?

Timeframe and apparent accuracy

Responsible futures management combines short-term and long-term perspectives. However, those responsible frequently request studies with a timeframe of five to eight years. With such a narrowly defined range of time – given the dramatic upheavals taking place at the moment – the differences between forecasts and status quo are generally microscopic.

Particularly for major players in the energy sector, long-term planning entails calculating the costs for a gas turbine down to the last cent – 20 years in advance. This calculation suggests reliability. However, in light of structural disruptions in reality (such as Fukushima, the phasing out of nuclear energy and legislative reforms), this apparent accuracy has been quickly and mercilessly shown to be false. Therefore, our study takes a different approach and provides very long-term scenarios with a view to the year 2035 and beyond.

Surplus of studies and use of results

The overabundance of studies on energy topics in the last few years has contributed to a false sense of security. Rather than providing forecasting validity for sector decision-makers, the scenarios were based on false premises and/or the pace of developments in the field was underestimated. Therefore, continuous and intensive analysis of future challenges is required. It is essential that the people responsible have a profound understanding of the various scenarios and basic premises. With our study, we therefore hope to inspire you to participate in the process of developing and analysing scenarios. We would also like to encourage you to consider how the hypotheses, results and trends might affect your own company.

The goal of our study is to demonstrate how diverse scenarios need to be for flexible and agile strategic planning. By providing those responsible for company personnel with a "spectrum of futures", we aim to support in reducing uncertainties – according to the principle "He, who is aware of various alternative futures, will recognise the right one for himself."

Key Results

"You never touch a river in the same place since the water changes every second. However, it will always be the same river that you touched."
Unknown source

The future is not easy. Quite the opposite: as this study shows, the future will be determined by a multidimensional field of factors; everything plays a role.

This vague "everything" can best be handled by applying a variety of methods, with a range of perspectives and futurology processes. This study deals with the complexity by including conceivable, probable and desirable scenarios, surprising developments (so-called "wildcards") and current uncertainties, as well as innovations and tips to avoid cognitive distortions.

The main results of the study can be summarised as follows:

1 Simplicity

is the new paradigm for the energy sector – it is not the best companies that win, but rather the simplest. Successful companies are those with the simplest – that is, the catchiest, most believable and most effective – messages, products, services and communication structures.

2 Diversity

is the key to transformation of the sector: if, for instance, Google operates wind parks and applies for a licence to trade electricity, the industry's boundaries come crashing down. The strategic response to this is not defence, but rather diversification.

3 Innovation

leverages progress: this will no longer come from companies' secret research laboratories, but will be developed in open innovation and foresight platforms.

4 Employer branding

attracts employees to sectors and companies: image campaigns from both established companies as well as industry associations will have to reinforce employer branding in the long term.

Targeted communication

5

will become a core competence: plain old "information events" no longer hinder grass-roots protests. The industry communication of the future will work with "stories"and change attitudes with appealing narratives.

The biggest stumbling block

6

for the future of the energy sector is cognitive distortions – so-called biases: the biases of individual managers in perception and thinking first need to be identified and eliminated. Otherwise, the traditional management mind-set will be ineffective in achieving the comprehensive transformation needed by companies and the sector as a whole.

Wildcards

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are surprising events with major consequences and are among the greatest threats to the industry. People who only perceive them as threats, however, might miss out on opportunities. The long-awaited "energy miracle"[1] may well emerge from such a surprising development.

Many companies in the energy sector have been using scenario analyses and other future research methods for a long time.[2] However, incompetence in futurology is not due to a failure to use scenario analyses; the problem stems from not using them as often as required. In a nutshell: only once hardly makes an impact, and infrequently is not enough.

Companies with successful futures management have structured, standardised, prioritised and systemised processes. Above all, they have stabilised them – and the desired futures competence can only be ensured by their continuous application, which requires correspondingly qualified personnel and organisational development.

1 See definition on page 13

2 See also: van der Heijden, K. (2005); de Geus, A. (2002)

Turning Knowledge into Action

"Everything that can be invented has already been invented!"
Widely attributed to Charles Holland Duell (1850–1920), Commissioner of the US Patent Office

In order for knowledge from scenarios and analyses to have value for an industry or a company, it must be put into practice. The human factor plays an important role in this transfer, but people inevitably make misjudgements. Four classical errors in reasoning are:

The Zimbardo-Boyd time paradox

Two US researchers, Philip G. Zimbardo and John N. Boyd, have determined that every person, without generally being aware of it, has a preference for a certain era. Briefly, this means that there are nostalgic people living in the past, people living in the present and visionary people living in the future. The problem is: if a person plans ahead, his subjective time preference distorts his perspective. The nostalgic person, for instance, initially observes the future sceptically. By contrast, the visionary person impatiently anticipates, researches, plans and invests in the future. Then, a particular technology proves to be less promising than expected – and losses are made. Under certain circumstances, this may happen again and again before the person recognises the pattern of thought. In order to diagnose individual time perspectives, researchers have developed a detailed test called the Zimbardo Time Perspective Inventory (ZTPI).[3]

The memory effect

The ability of a person to anticipate future developments depends not only on his foresight, but also on his power of recollection. The future and the past are processed in the same region of the brain. "Whether we can remember an event or imagine the future is almost the same thing," Harvard psychologist Daniel Schacter says.[4] This coupling has evolutionary reasons. "If somebody can remember how hungry he was last winter, there is more motivation to store something away for the coming winter," the neurobiologist Endel Tulving from the University of Toronto explains.[5]

Let's transfer this memory effect to the energy industry. Can you remember the two oil crises of the 1970s? How did European motorists replace their usual form of transportation? At first glance, questions like this appear to be trivial. Someone who can recall the history of energy, however, also exercises his ability to create scenarios for the future. And the person who systematically reflects on past events and decisions evades the dictates of urgency, the mental prison of the here and now – and thereby improves their futures competence.

The retrospective block

Managers make mistakes when looking into the future. Even after committing serious errors in forecasting and strategy, some decision-makers are still convinced that their futures competence is impeccable. Researchers refer to this effect as the retrospective block[6]. The people concerned almost always think that they foresaw an event in retrospect although, objectively, this was not the case.

Managers, who are futures competent, regularly write down their estimations of the future and oblige their staff to do the same thing. They frequently turn this work into team exercises, integrate the written projections into their meetings, enter the results in the meeting protocol, and continuously compare their estimations with actual events.

The character effect

The future is a question of character. For the optimist, it looks rosy; for the pessimist, it tends to look dreary. The apprehensive person perceives risks in the future that the fatalist does not because, in his or her opinion, things happen that have to happen. If you have ever wondered why developments are often severely underestimated, an explanation can be found in the variation of character (see the "What type of futures character are you?" box).

Character affiliation may change. A study[7] proves the preconception: young people view the world more optimistically. The older a person is, the more pessimistically he or she will view the future.

3 Zimbardo, P. G./Boyd, J. N. (2008)
4 Kleinschmidt, C. (2009)
5 Ibidem
6 Goodwin, P. (2010)
7 Lang, F. R./Weiss, D./Gerstorf, D./Wagner, G. G. (2013)

What type of futures character are you?

In an online survey[8] of 1,017 people between the ages of 17 and 35, the Mindline market research institution determined the distribution of futures types of which:

- 27 percent were optimistic
- 19 percent were apprehensive
- 18 percent were hopeful
- 15 percent were pessimistic
- 11 percent were pragmatic
- 5 percent were fatalistic

How would you rate yourself?

How does this change according to the type of decision you are making?

People who can answer these questions are able to restrict character-related distortions of their view of the future.

Additional errors of reasoning

Whether it is exaggerated optimism, temperamental effects, emotional contamination, superstition or illusions of control – the list of potential misconceptions is long. Desirability bias is also widespread: a study[9] has shown that decision-makers assign higher probability to desired events – as much as 25 percentage points more than that of an undesired event – although the objective probability of the two events is the same.

On the one hand, this is shocking. Our subconsciously operating mind and our undetected misconceptions are the worst enemies of the future. On the other hand, this indicates an urgent need for training: if we begin to learn from age-old misconceptions, our future will be better than we can imagine it to be from today's perspective.

Checklist: management transfer

- Be aware of the "affective setting" of every meeting that deals with the future. Positive retrospection casts an equally positive light on future scenarios; negative retrospection has exactly the opposite effect.
- Pay attention to diversity. Different misjudgements often offset each other. It is therefore a good idea to contemplate future issues together in large groups.
- Computer-based Foresight Support Systems (FSS) help in avoiding the most frequent errors in reasoning in analyses – until transferral of results occurs.[10]
- Recognise avoidable misconceptions and continuously keep track of them in a list.
- Never attempt to avoid every misconception. This is tremendously time-consuming and, in practical terms, impossible. You will still make unavoidable mistakes – which is perfectly acceptable. When it comes to futures competence, in fact, there are no "mistakes"; just cues for the right solution.

8 STERN (2014)
9 Ecken, P./Gnatzy, T./von der Gracht, H. A. (2011)
10 See IFK (Ed.) (2013); Bañuls, V. A./Salmeron, J. L. (2011)

1 Current Challenges
An uncertainty analysis

"The wisest understand the future, the less wise the past, and the even less wise the present."
Lu Bu We (ca. 300 BC) Chinese philospher, merchant and politician

How successful an industry will be in the future depends on the uncertainties of the present. The person who is best able to estimate potential risks and important trends today, develops the best futures scenarios for tomorrow. Therefore, a scenario study is not judged as being successful because of the actual occurrence of a single scenario, but by the number of findings among all scenarios that result in the right and most worthwhile decisions. Which uncertainties require future-orientated scenarios? Which areas are currently causing tensions in the energy sector? Three major issues can be identified:

1.1 The political framework

1.1.1 New alliances and power options

Energy means power and security. Energy issues determine the balance of power, they set the daily political agenda and they promote strategic alliances. This was demonstrated by the oil embargo of 1973 when the global economy became "hostage" to energy supplies. The immense importance of energy was also confirmed by President Jimmy Carter's declaration that he would not hesitate to start a war to assure the supply of energy.[11] The continuing importance of stable energy supply is illustrated by Russia's agreement with China in May 2014 to deliver 38 billion cubic metres of gas for 30 years at €290 billion – and its extension in November 2014 by an additional 30 billion cubic metres. A further example is the fracking and oil boom in the USA. Both developments have provided the country with energy autonomy for the first time in decades.[12]

Future wars might result from energy policies rather than territorial claims or disputes between nations. The conflict between various countries for raw materials and energy sources in the Arctic region is a prime example. A quarter of the world's undiscovered oil reserves are estimated to lie beneath the Arctic Ocean floor.

What does that mean for the energy industry? Will every executive suite of the future house a "war room"? Hopefully such drastic measures will not be needed. However, it is important that management considers a wide variety of scenarios – which is where the scenario technique returns to its military origins.

1.1.2 Structural breaks in Europe

Investments in the energy sector are unlikely to be made if the political framework is not clearly and credibly defined for the long term. In Europe, the industry complains far less about the direction set for energy policy as the indecisiveness of the players.[13] What politicians postulate with the left hand in the form of abstract energy and climate goals, they hinder with the indecisive right hand that cannot commit itself to more concrete details.[14] Or trust is destroyed by abrupt action; for years, billions were invested in the promotion of certain technologies until the political premise was altered – virtually overnight.

Will the EU stick to its relatively stringent objectives long term? Or will these become so diluted that every country pursues its own intentions (as is now the case)? The existence and success of the transformation of the industry depends on both scenarios. On the other hand, a once-in-a-lifetime project, such as the German and European energy transformation, needs a phased approach that learns from mistakes. This includes the ability to make detours and (sometimes) wrong turns. The situation demands a high degree of planning flexibility and agility among all the participants.

11 Bacevich, A. J. (2010)
12 Anderson, R. (2014)
13 Szulecki, K./Westphal, K. (2014)
14 The Economist (2014); Beckman, K. (2014)

1.1.3 Conflicting goals: climate protection versus the phase-out of nuclear energy

Contradictory goals pose the greatest challenges in the energy sector. In Germany, CO_2 reduction and climate protection targets conflict with the objectives of phasing out the use of nuclear energy and replacing it with alternative energy sources: replacing nuclear energy with coal-generated power would increase greenhouse gas emissions. Security of supply conflicts with affordability, because the supply must remain stable despite fluctuations in the production of renewable energies, even when prices increase dramatically.

These and other conflicts constitute a multidimensional area of tension with explosive potential and varying degrees of importance. During peak moments of crisis, the security of supply is extremely important for citizens.[15] As the crisis cools down, the affordability of energy becomes the highest priority. What will the focus of attention be tomorrow?

In the 1960s, the Stability Act[16] in Germany ensured clarity in the relationship between four interdependent goals: employment, price levels, balance of trade, and growth – the so-called "magical square". Unfortunately, a similar "magic" cannot be detected for the energy sector, despite comparable urgency.

1.1.4 Global conflict: full plate versus full tank?

The debate about biomass cultivation is a global field of conflict. Every acre of farmland that is not used for energy plants but for growing food attracts protests and sometimes very bitter public relations campaigns. Well-known people from politics, the research world and many other sections of society voice their concerns. The EU has tightened legislation in this regard. The facts speak for themselves: it is forecast that 70 percent more food will be required by the year 2050 than today.[17] Consequently, energy companies need to focus on new technologies more than ever, while intensifying their innovation efforts to produce energy from plants of the 2nd, 3rd and 4th generations.[18]

1.2 Social change

1.2.1 Fragmentation of social opinion processes

The energy sector has traditionally relied on lobbying as its political modus, since energy companies frequently operate in regulated markets that depend on the political setting.[19] In the digital age, opinions are no longer developed simply by means of lobbying or "classical" media work. The fragmentation of the media landscape allows new formats to arise – such as digital information and opinion platforms – that must be exploited quickly and in a variety of ways. Even for communication experts in the energy industry, it is a major challenge to keep an eye on the Internet's vast amount of traffic and players, and to counteract the increasing number of attacks, misinformation and myths. In the future, it will become even more difficult for non-specialists, like "normal citizens" or political decision-makers, to navigate their way through the digital jungle.

1.2.2 Civil outrage versus acceptance

The resistance of citizens to major infrastructure or power plant projects is a global phenomenon. Particular attention is paid to new power lines, wind parks, storage tanks or pipelines. From the socio-cultural perspective, there is no question that angry citizens will become even more active. The willingness of older and well-educated people in particular to support such protests is constantly increasing.[20] This development represents serious challenges for the companies affected: knowledgeable and demanding citizens must be informed quickly, clearly and credibly. Many people are no longer satisfied to know only if and what will be done; they also expect to understand why and in what manner – and how they can influence these factors. Some companies are already overwhelmed by this communication task and yet, in the future, it will be essential to develop core competencies in this area. The only projects with a chance of succeeding are those that, through sensitive communication, are able to anticipate and address the resistance of concerned citizens.

15 ZEW (2014)
16 Bundesministerium der Justiz und für Verbraucherschutz (1967)
17 FAO (2009)
18 Kagan, J. (2010); EIRIS/imug (2014)
19 See Müller, B. (2012)
20 Kurbjuweit, D. (2010); Walter, F. (Ed.) (2013)

1.2.3 Education and awareness

The lack of futures competence in many companies is the expression of a deficit within society as a whole. Compared with the historical sciences, the number of research programmes for future studies is extremely small – a shortage that the visionary H. H. Wells criticised as far back as 1932 in his BBC interview "Wanted – Professors of Foresight!".[21] Today, it is possible to study futures research at only 50 out of over 10,000 universities worldwide. There are a number of so-called educational dilemmas responsible for this deficit.[22] One is the social trap: nobody tends to sharpen their futures competence in energy issues as long as – by way of example – the benefits of an old refrigerator, in the form of a cold beer, is privatised, while the (external) costs of obtaining energy are socialised. An additional example is the spatial trap: the benefit of energy consumption happens at one place, while the damage occurs at another location.

Therefore, both the energy sector and society urgently need an educational offensive on the subject of futures competence. The growing number of people, who are aware of sustainable energy sources and consumption issues, may accelerate this process. LOHAS (lifestyle of health and sustainability), PARCOS (participative consumers) or SCUPPIEs (socially conscious upwardly-mobile people) are only some of the examples of dedicated lifestyle groups. Among others, they are pioneers in the use of household and entertainment devices with their own energy management (smart home) features. They use tools to measure and analyse personal behaviour – like their pulse rate and performance profiles when jogging. They also use this data to compare themselves with their peers. The consumer behaviour of these pioneers can make an important contribution to the spread of smart homes or other energy management systems.

1.3 Market transformation

1.3.1 The loss of traditional business models

Current and imminent uncertainties are particularly apparent in the progressive erosion of business models within the energy industry. Electricity can now be purchased at the supermarket, the post office or in large online portals. Providers are frequently new and powerful players from the IT sector, such as Deutsche Telekom, Cisco Systems, IBM and Google Energy. According to one recent study, 43 percent of the German energy suppliers surveyed rank short-term defence against these competitors as a top priority.[23]

The industry is also being subjected to enormous pressure by the trend towards the decentralisation of energy production and diversification of power plant operators. Institutional investors are putting their capital in new generation capacities, while more and more customers – commercial as well as private – are also becoming self-suppliers. Consequently, the energy sector is faced with many questions, such as: Who controls these plants? How should the pricing models be modified?

In the light of these existential threats, scenarios that deal with alternative market developments and defence strategies have become increasingly important. As a result, some energy companies have already established multidisciplinary transformation teams consisting of engineers, IT specialists, psychologists and theologians. Smart home and energy efficiency markets play important roles in their strategies.[24] New business models might also be developed from technological advantages that do not come from the energy sector itself. A current example of this is the electric car manufacturer Tesla, which has disclosed all 160 of its patents in order to accelerate the spread of innovation.[25] The minimum requirement to handle such technological advantages professionally is a "futures radar".

21 Wells, H. G. (1932)
22 See Ernst, A. (2010)
23 F.A.Z. Institut für Management/Steria Mummert Consulting (2010)
24 Heitker, A. (2014)
25 Ohnsman, A. (2014)

1.3.2 Energy Google

The energy industry is undergoing a wave of innovation that has never been experienced before. The idea-of-the-millennium is bound to be among the many innovations. According to Bill Gates, it is high time; the Microsoft founder is of the opinion that climate goals cannot be achieved with existing technologies.[26] A major "energy miracle" is required, similar to the emergence of the Internet or the invention of the personal computer, or many small wonders.

The prerequisites for these wonders are the same as those for the scenarios of our study: farsightedness in politics, creativity among research groups, increased entrepreneurship in business, and absolute transparency in society – precisely the things needed to produce such outlandish ideas as Google Energy.

If the next Kondratieff wave[27], or innovation cycle, occurs in the energy supply arena, it would provide an enormous boost. The consequences would be comparable to those of the previous five 50-year cycles with the inventions of steam engines, trains, electricity, personal mobility (automobiles, combustion engines) and information technology. It would be more than a matter of industry transformation: it would be a new era.

Empirically, the writing is on the wall: every new Kondratieff cycle of the past has been preceded by a global crisis. So the current financial and debt crisis yields hope, as paradoxical as that may sound.

1.3.3 Mega-projects: gold mine or bottomless pit?

Mega-projects in the energy sector that are relevant for the entire economy require significantly greater investment volumes than traditional major projects. Setting up a completely new energy infrastructure will need funding in the two to three-digit billion range.[28] This holds true for both the European super grid as well as for extensive use of liquefied natural gas (LNG). In addition to the high financial risks, there may be other imponderables, such as the research project ITER (International Thermonuclear Experimental Reactor – in Latin, "iter" means "the way"). Here, even the researchers involved cannot say if nuclear fusion will ever function stably. The costs for the project – originally estimated at €5 billion – have risen to €15 billion, with even greater sums being discussed behind closed doors. In contrast, the political uncertainties as well as the financial volumes (€400 billion/$555 billion) and technological risks are prompting investors to exit the DESERTEC electricity project.[29] The tensions caused by high risks and the urgent necessity to find new resources are being aggravated by numerous, previously unknown uncertainties. Are mega-projects a gold mine or a bottomless pit? This question is ominous and explosive.

26 Gates, B. (2010)
27 Allianz Global Investors (2013)
28 Kaiser, A. (2014)
29 Steitz, C./Hack, J./Sheahan, M. (2014)

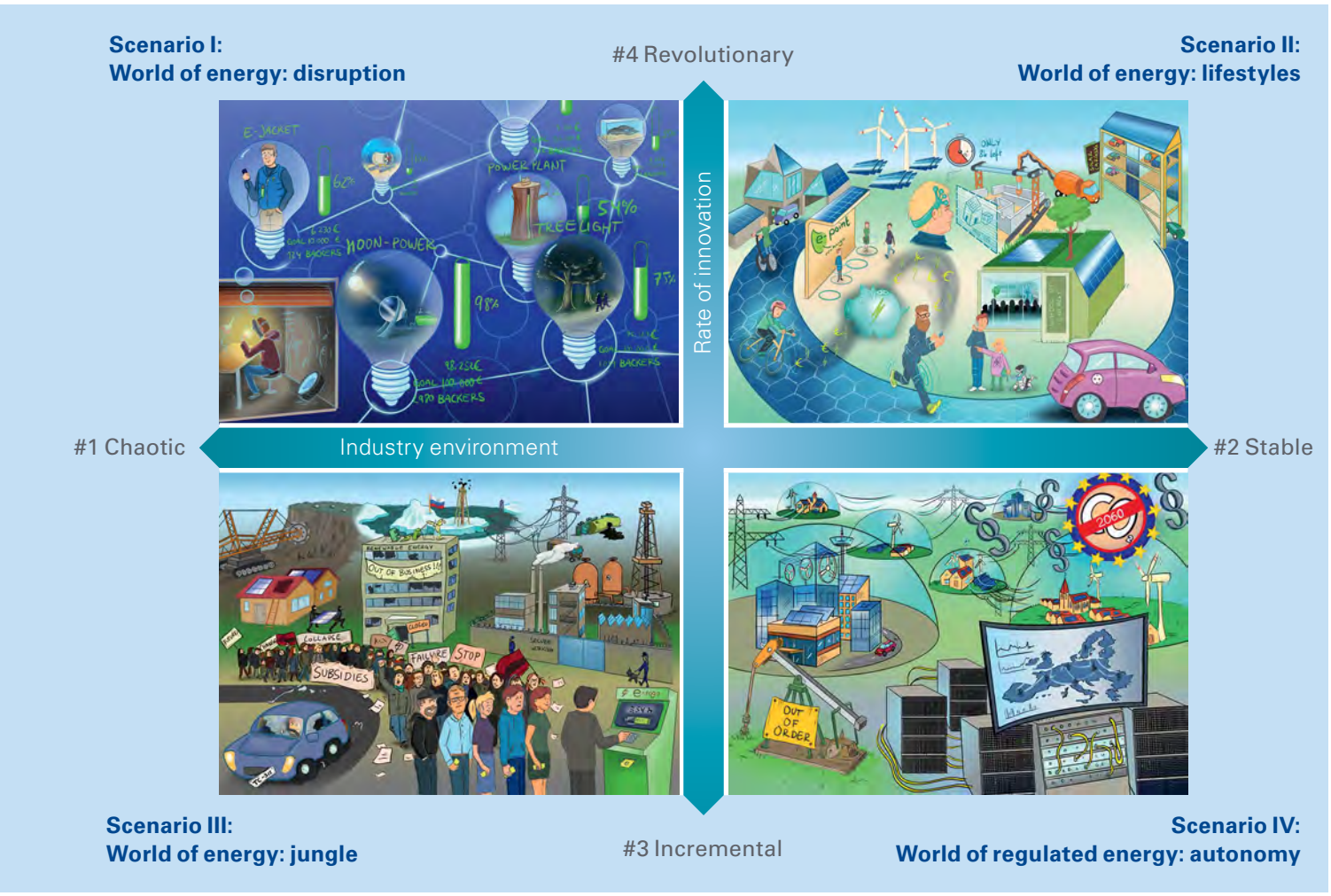
2 Scenarios 2035Plus
The broader perspective

"It is not a matter of predicting the future, but rather preparing for the future."
Pericles (500–429 BC)

The development of futures scenarios for this study was performed by means of the scenario axis method (2×2 matrix), which has proven useful in numerous scenario projects.[30] The scenario studies of the World Economic Forum serve as an example.[31] Since certain aspects in the scenarios may have impacts beyond the year 2035, we have set the scenario horizon at 2035Plus.

The specific scenarios were developed iteratively based on expert workshops and interviews as well as comprehensive database research. The future determinants "innovation tempo" and "industry environment" were stipulated as scenario axes due to their high degree of relevance. In accordance with the method, four opposite, characteristic poles were initially defined and combined into "rough scenarios".

The next step was to develop various scenario plots on the basis of eight dimensions (see p. 16, e.g. technology, energy mix). This was performed in accordance with established scientific quality criteria for scenario writing.[32] Plausible scenario titles refine the images of the future. Since the discussion of possible scenario paths is important in addition to the scenarios themselves, these paths were also considered in the study.



30 van 't Klooster, S. A./van Asselt, M. B. A. (2006)
31 WEF (2009)
32 Schnaars, S./Ziamou, P. (2001); Hirschhorn, L. (1980)

Definition of the scenario poles

A futures space is developed with four opposing scenario poles on two different axes. The following illustration shows the basic assumptions per axis.

X-axis: Industry environment

#1 Chaotic — 2035Plus — **Stable #2**

- High dynaxity (dynamics and complexity)
- High uncertainty
- Strong fragmentation of the markets
- Irrational behaviour and irrational decisions
- High volatility
- Strong market imbalance

- Low dynaxity (dynamics and complexity)
- High sense of security
- Rational behaviour und rational decisions
- High predictability
- Linear development
- Balanced market

Y-axis: Rate of innovation

#3 Incremental — 2035Plus — **Revolutionary #4**

- Constant and phased improvement of existing products, services, processes and business models
- Short to mid-term impact of innovations
- Widespread me-too strategies
- Relatively simple innovation processes
- Slow rate of innovation

- Technological advances
- New patterns of thinking and acting
- Long-term, transformative impact of innovations
- Formation of new markets
- Wide-ranging co-opetition and co-creation/open innovation
- Quick rate of innovation

Scenario I

2035Plus: World of energy: disruption

The world has developed very dynamically, especially in China and India. Global energy needs have increased by 80 percent. The scarcity of resources (with regard to energy resources, water, land and food) has increased dramatically. "Scarcity management" is a buzzword in Europe that describes how scarcity is used as an innovation driver.

Society in Europe is characterised by a highly participative attitude on the part of people in 2035. The former "angry citizen" has become an "active citizen" who is constructively involved in shaping the energy future. Consequently, the number of citizen action groups, interest groups and lobbyists has grown exponentially, and the complexity of the energy sector has increased significantly.

Technology plays a dominant role. The innovation cycles in the energy sector have decreased dramatically in the past 15 years as a result of growing crowd innovation and co-creation, in which the customer is included in the innovation process. Crowdfunding has become common practice for financing technologies. Young entrepreneurs, start-ups and tinkerers keep the European energy sector hopping to such an extent that the traditional balance of the industry is disrupted. In parts of Europe, oil and gas reserves are inexpensively exploited in unconventional methods with new fracking technologies.

Value creation in the European industry of 2035 has been revived as a result of the reindustrialisation – which has improved the innovation climate in general. Industry 4.0 is advanced, but is slowed by the development of island solutions and challenges due to new standards. Nevertheless, there is a sense of optimism and excitement. Customers are included in the value creation processes of companies through open innovation.

The energy mix has become highly diversified by the year 2035. The sector is defined by many new niche technologies, with new ones being added constantly and quickly. The portion of fossil fuels in the global energy mix has decreased significantly, while the prominence of renewable energies has increased dramatically. The "energy industry map" has been redrawn – it has fragmented into innumerable niches.

The energy infrastructure in 2035 is facing enormous challenges. Many individual and decentralised solutions for energy generation, distribution and storage are managed intelligently in the smart grid. The interoperability of this "patchwork" has become a mammoth task that can only be handled with the aid of major IT companies.

Companies complain less about high energy costs and more about the lack of smart grid stability and security. The business models in almost every industry have been turned upside-down in the past two decades. The pervasive integration of telecommunications, IT and media with the energy sector as well as unforeseen but positive technological advances, has radically transformed the energy industry.

EU policy-makers have decided on pragmatic compromises after years of dispute about the direction of policy. By 2035, the member states have become ambitious about climate policy. Energy policy decisions can be made faster. Europe has been able to expand its worldwide pioneering role in the field of energy efficiency even further.

2020

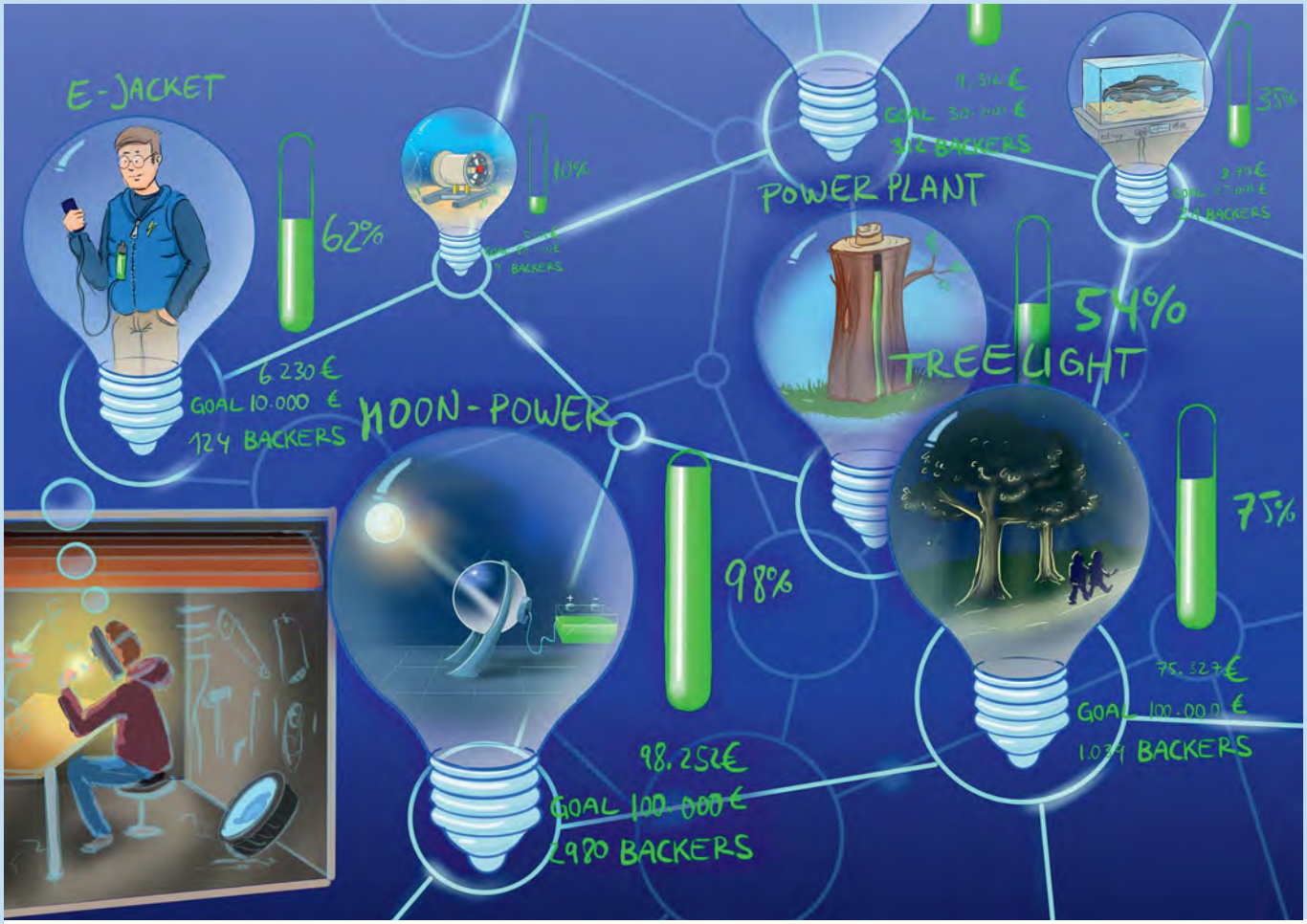
Breaking news from an international energy agency: "Electricity consumption in China has doubled since 2010 (to 8,200 TW); in India it has tripled (to 2,000 TW)."

A financial newspaper headline: "Global crowdfunding boom – volumes increase to $35 billion (2012: $2.7 billion) – with growth rates of up to 30 percent annually (Germany 2020: €359 million)."

2025

A renowned foundation reports: "World population hits 8.1 billion (2014: 7.2 billion); population in Europe stagnates at just over 500 million (2014: 507 million)."

An economic research institution reports: "Percentage of industrial companies in EU gross domestic product (GDP) increases to over 20 percent (2013: circa 15 percent)."



2030

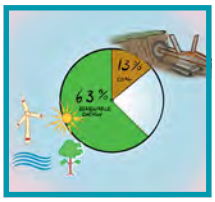
Top news: "Food shortages increase dramatically – worldwide only 1,800 m^2 farmland per capita (2005: 2,300)."

EU report: "EU countries reduce energy consumption by 38 percent since 2015."

Thirst for energy causes lack of water: energy production responsible for 19 percent of the global water consumption (2014: 15 percent)."

2035+

News ticker: "Energy powerhouse Brazil reports: Oil production tripled to ca. 6 billion barrels per day since 2015."



Industry study examines current figures: "EU market for smart grid increases to over €260 billion."

Press conference on new EU energy report: "Coal decreases to 13 percent of European electricity mix (2012: 24 percent); renewable energies assume dominant role with 63 percent (2012: 28 percent)."

Scenario II

2035Plus: World of energy: lifestyles

The world has become even faster paced in 2035. As a result of real-time translation, the linguistic barriers have widely disappeared. This development has allowed the formation of the central Asian block – driven by Russia and China – to progress rapidly in the last two decades. The European member states have also grown closer together as a world region.

European society in 2035 strives to lead a modern, ethically mature and powerful lifestyle. It has become "hip" to live and work energy-efficiently. Citizens collect and trade negawatts – that is, the energy that they have not consumed in savings accounts. Extremely energy efficient morphing apartments and houses with solar windows and solar coatings are the latest trend. "Energy saving" has become a popular elective in schools.

Technology in 2035 is an expression of lifestyle and is "in". It is on display everywhere – be it a smart home or the latest wearable technology (WT) clothing. By means of energy harvesting, consumers collect energy from light, heat and vibration, for instance, when sleeping or at the gym, or walking or driving down the street. Electromobility – intelligently promoted with privileges for users – has become a mass market. Electric vehicles are used as decentralised power parks.

Value creation in 2035 in Europe is aimed at a balance of production and services, with collaborative consumption representing a major portion. Cyber-physical systems that combine the data from virtual planning and real production are widespread in industry and widely operated by means of brain-computer interfaces. 3D printing and copying are part of everday life.

The energy mix in Europe is characterised by a high percentage of coal and renewable energies. In 2035, the chemical industry frequently uses CO_2 as a raw material; coal-fired power plants with CO_2 emissions, usage and storage are booming. In addition, this guarantees independence from oil and gas imports.

The energy infrastructure links producers, energy storage and consumers in an intelligent manner. Buildings, vehicles, households and appliances, and even people's clothing, are connected in the Internet of Things and record energy-relevant data in real time. In some cities, it is even possible to tap into or trade energy from hotspots while passing by. In addition, software and hardware are in use for predictive analytics in order to make load management more professional in areas where the grid is not sufficiently developed.

Companies in parts of Europe struggle in 2035 with the challenges of the labour market (lack of qualified personnel). However, jobs in the energy sector are extremely popular. The field has become increasingly attractive because energy has become a lifestyle product.

EU policy advances the efforts to "Europeanise" the energy industry. After years of a successful energy union – the merger of Europe in the energy sector – more progress on the European super grid is being made than ever before. This super grid system is within reach in 2035.

2020

Energy savings forums are booming in the Internet. Homeowners are outdoing each other with savings. The best are reducing their CO_2 footprint by up to 60 percent with energy efficiency measures.

Top news: "Market for energy harvesting products reaches $4.4 billion (2010: $605 million)."

2025

Innovation at the world's largest trade fair for consumer electronics: a number of renowned manufacturers simultaneously launch thought-controlled products.

The bilateral volume of trade between Russia and China grows to $240 billion (2012: $87.5 billion).

More than 7 million electric vehicles are on the road in Germany (2013: circa 12,000).

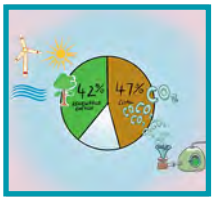
2030

Housing upheaval in the EU – 3D printing (contour crafting) drives housing construction; restoration rate at record level of 3.5 percent (OECD countries 2014: approximately 1 percent).

The Internet of Things is exploding. Experts estimate that there are currently 100 billion devices connected (2014: 14 billion).

2035+

Current studies show: "EU citizens procure only half of their consumer goods with money – everything else is either barter or sharing."



Press conference on new EU energy report: "In the European electricity mix, coal – with about 47 percent (2012: 24 percent) and renewable energies – with 42 percent (2012: 28 percent) play the dominant roles."

Scenario III

2035Plus: World of energy: jungle

The world looks back on years of riots, wars and conflicts. Globally, the number of confrontations has increased dramatically. The population explosion in the former emerging countries as well as the inequalities in distribution and the scarcity of resources are the primary motives and the breeding grounds for armed conflict. In Europe, countries have been defending their identities and interests in the strongest manner possible and therefore discredit the European Union.

Society in the European countries is fighting against the high level of energy criminality. Transmission lines are being tapped. In some rural areas, there are civil wars because the inhabitants are stealing electricity and equipment from one another. Energy luxury goods, such as vehicles or machines, are sabotaged or stolen by energy rebels. In the previous winter, thousands of energy refugees flocked from the colder countries into the warmer regions.

Technology in 2035 has lost its shine as the "problem-solver". After "E-Day – when the energy transition bubble burst in Europe – and subsidies for renewable energies ended, innumerable companies went bankrupt. People slipped into energy poverty and the number of customers whose electricity has been cut off has more than doubled in the last ten years. Many people can only obtain electricity for a certain number of hours using prepaid cards.

Value creation and economic growth in Europe are at a standstill due to ongoing international conflicts. The ambitious plans of Industry 4.0 have failed for the moment. Companies aim to safeguard raw materials and supply, which has resulted in significant efforts in reverse integration. The Arctic Ocean is ice-free for the first time in the summer of 2035. New shipping routes and development areas are sharpening the conflicts amongst bordering countries.

The energy mix in Europe in 2035 is characterised by a high percentage of fossil fuels, primarily lignite. Nuclear energy is enjoying a comeback worldwide (also due to its potential military application in the continuing crises). The new role model is China, which leads in both Nuclear Energy 2.0 as well as with the construction of the demonstration reactor for nuclear fusion. The nuclear start-up scene has been booming in the country for years. Fracking continues to be used throughout the world to safeguard strategic supply, despite the risks for the environment.

The energy infrastructure has frequently collapsed in recent years; it has become a favourite target for terrorists. In 2035, facilities and networks for power generation are particularly endangered, as well as the transportation and distribution networks. Contingency plans only function to a limited degree.

Companies are suffering due to international conflicts and energy criminality. Security costs are exploding and forcing everyone to seek opportunities for energy autonomy. Therefore, corporate conglomerates have been forced to become power plant operators to a much greater degree than in the distant past.

EU policy in 2035 is marked by years of polarisation and European-sceptical choices of member states. Supranational players and agreements have been frequently blocked and generally met with mistrust. The right-wing populists have been able to expand and maintain their influence throughout Europe. At the same time, the voices for a re-establishment of the trans-European awareness have grown louder.

2020

Top news: "Theft of more than 10,000 solar modules between January and December 2020 in Germany causes millions in damage (2014: circa 3,000 modules)."

A current study shows: "The number of attacks on energy infrastructure in the last decade has almost doubled – from 2010 to 2020: Ø 775 (2000 to 2010: Ø 422)."

2025

Headlines in a major tabloid: "E-Day: burst of energy transition bubble forces 300,000 western European companies into bankruptcy (2012: 178,000 bankruptcies)."

China builds its 135th nuclear power plant (July 2014: 20) – by 2050 plans are for 500 nuclear power plants to cover 15 percent China's energy needs.

Chaotic

Industry environment

Rate of innovation

Incremental

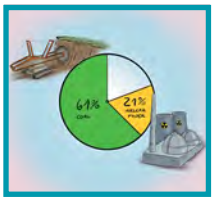
2030

An institute for international conflict research announces: "Number of conflicts worldwide, at about 600, sets new record (2013: 414 conflicts)."

Top news concerning energy poverty: "An interruption in the supply of electricity threatens over 14 million households in Germany alone (2011: 6 million). In total, electricity was cut off in about one million households (2012: 321,539 households)."

2035+

South Korea leads the competition for nuclear fusion – first commercial reactor planned to go online in 2036.



Press conference on new EU energy report: "The energy sources coal – with 61 percent (2012: 24 percent) and nuclear energy – with 21 percent (2012: 26 percent) dominate the European electricity mix."

Scenario IV

2035Plus: World of regulated energy: autonomy

The world has grown closer together in 2035. Many people consider themselves to be "citizens of the world", which significantly promotes international cooperation. Europeans with cosmopolitan mindsets understand cultural, religious and social heterogeneity as capability. By means of clever regulation, the EU has succeeded in the last 20 years in generating greater stability and security.

Society exhibits a strong desire for independence. Numerous EU countries have, one after the other, passed their own Energy Autonomy Acts (EAAs). Households, communities and states should cover their own energy needs, for instance, with photovoltaic on roofs, by means of fully insulated facades, heat pumps in the cellar or by using geothermal energy or wind. Those who can afford it now operate their own bacteria and micro algae power plants.

Technology for decentralised production of energy has been massively subsidised for years in Europe. The research focused on renewable energies and their development has quickly borne fruit; the energy efficiency and balance of costs has continually improved, both with regard to wind and solar energy as well as biomass (in particular, waste wood and straw). The establishment of a modern, European-wide electricity grid has also made great progress in 2035.

Value creation is booming in the field of environmental technologies. Many sectors, such as electronics, IT, mobility and chemicals, focus specifically on this market. European products have become world market leaders in energy efficiency. Therefore, it has been possible to constantly reduce the dependence on importing energy raw materials in the last two decades.

The energy mix in Europe in 2035 is marked by a high percentage of renewable energies for the generation of electricity. Oil reserves have been almost completely depleted and the end of the worldwide fracking boom was reached in 2023. Russian gas deliveries quickly decreased to a subordinate role in the western European energy mix due to the frequency of pipeline closures.

The energy infrastructure in 2035 has become highly decentralised. Villages, communities, towns, cities and companies are striving to become energy autonomous and supply the majority of their own electric power and heating needs themselves. Regional energy collaborations have proven to be long-term success models.

Companies in 2035 are rewarded with tax deductions for proven energy avoidance. Thanks to the EAA initiatives and the technological innovations, a period of economic growth was unleashed in Europe in the early years. Demographic change could be compensated for by advances in automation, to some degree, so that the unemployment rate in Europe has stayed in the low single digits for years.

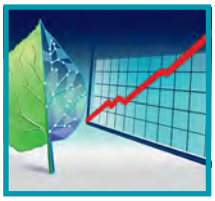
EU policy never lost sight of the roadmap for a long-term new energy model in 2035. Political and economic decision-making processes are characterised by a high degree of ongoing involvement by the various stakeholders. The current EU roadmap is the "Zero Carbon Economy" by 2060.

2020

Top news: "In 2020, 18 percent of total electricity needs are already supplied by equipment that private individuals and companies operate themselves (2012: 11 percent)."

Worldwide fracking boom comes to an abrupt end; exploitation rate of every source of gas is only half of original forecasts due to the striking rate of depletion.

2025



The economy is booming. Economic growth (change of real GDP in percent) in the EU is 3.7 percent (2000: EU-15 3.9 percent; 2013: EU-28 0.1 percent).

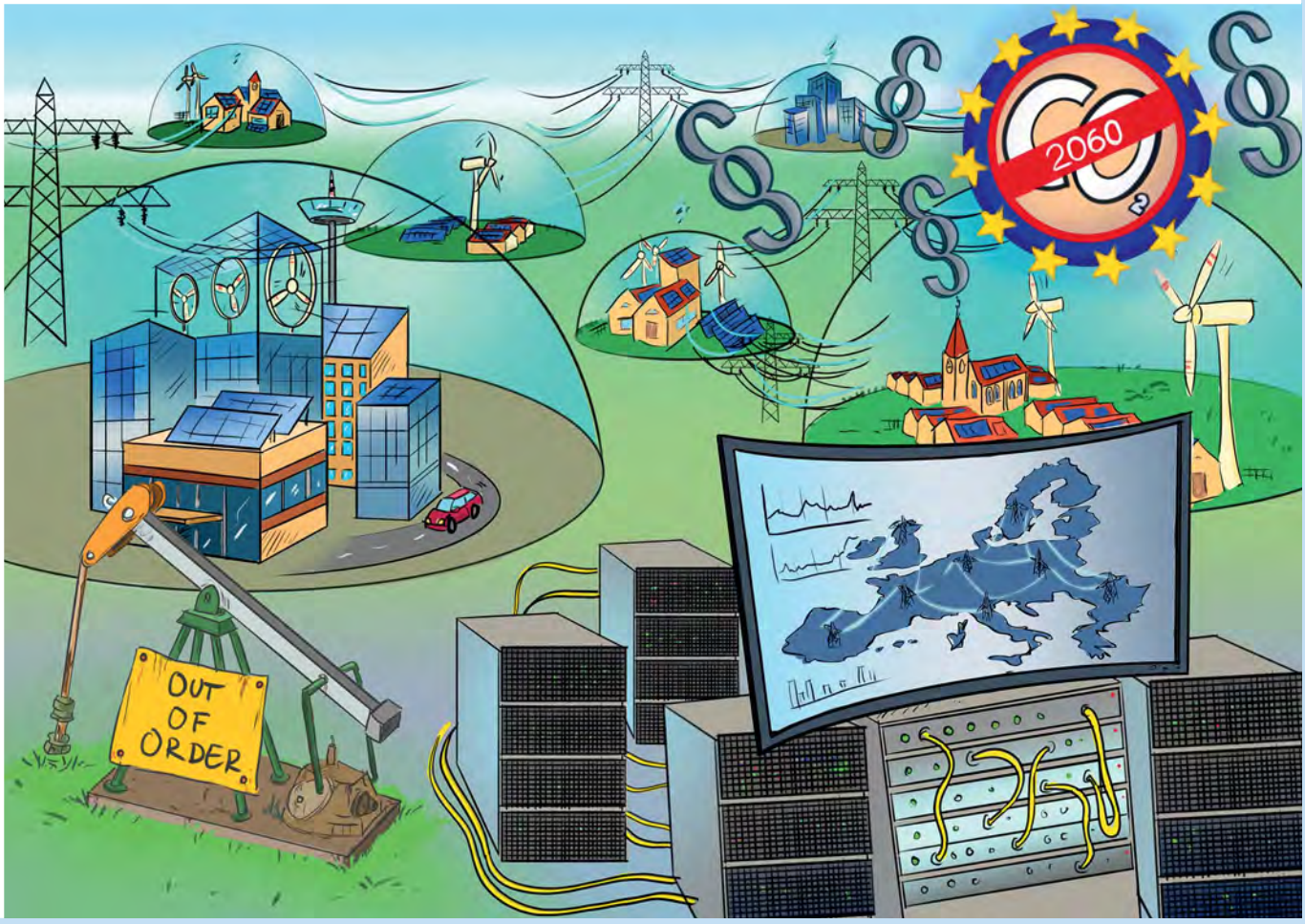
The worldwide market for environmental technology reaches a volume of €4,500 billion (2011: €2,044 billion). German companies hold a market share of 18 percent (2011: 15 percent).

Industry environment

Stable

Rate of innovation

Incremental



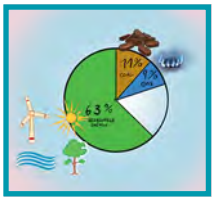
2030

Current studies show: "Europe's dependence on energy resources imports is only 32 percent (2011: 54 percent)."

News: "Historical event: The number of robots in the world surpasses the number of people. More than 2 billion jobs have been replaced by them since 2015 – at the same time, 70 percent of jobs in 2030 have been created in the last 15 years."

2035+

Press conference on new EU energy report: "The portion of coal in the European electricity mix has decreased to 11 percent (2012: 24 percent); natural gas contributes 9 percent (2012: 21 percent); renewable energies play the dominant role with 72 percent (2012: 28 percent)."



The unemployment rate in the EU is at 4.8 percent (2013: 10.9 percent); in Germany 3.4 percent (2013: 6.9 percent).

3 Trend Universe
The opportunities of tomorrow

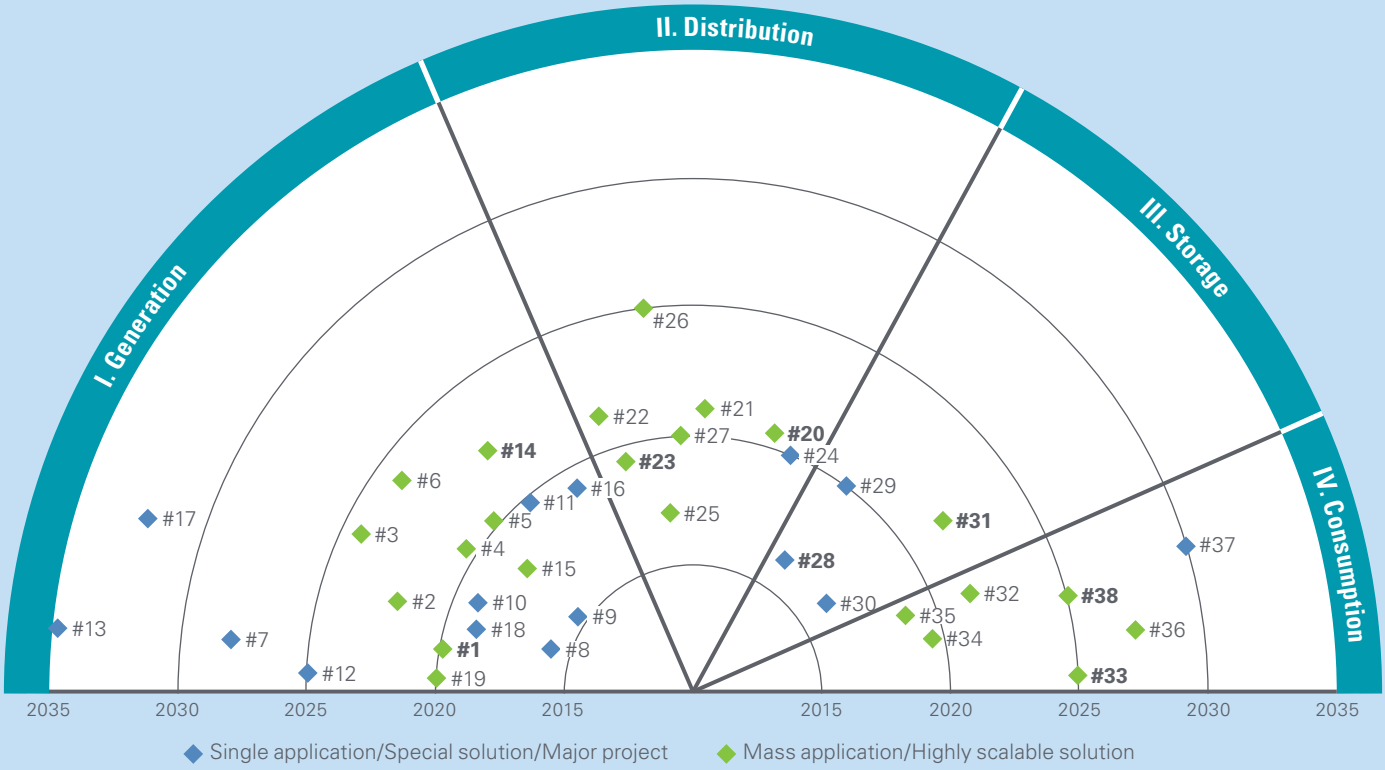
"Oil is a useless secretion of the earth – a sticky liquid that stinks and can not be used in any way."
Adademy of Sciences in St. Petersburg (1806)

The search for innovations determines the future of the energy industry, the livelihood and success of every company as well as its managers and, therefore, the work of every Future Group in the company. What will be the next "big thing"?

The Innovation Radar is a helpful tool for corporate teams to identify trends, innovations and opportunities in a concentrated form. We provide a comprehensive example in the study with 38 future opportunities that are categorised according to scalability, value-chain stage and expected time horizon.

For this executive summary of the study, we have selected eight exemplary opportunities that may provide valuable impetus for your own futurology work.

Innovation Radar
Source: KPMG in Germany, 2015



3.1 Generation

#1 Electricity from moonlight (2020)

The Beta.ray collectors from the Rawlemon Company are so highly efficient that they even transform moonlight into electricity. The first mass product for charging mobile telephones should enter the market in the coming days. In four to five years, the mass production of glass facades for office buildings should commence, allowing for light striking windows at an angle greater than 50 degrees to generate energy.[33]

#14 Electricity from solar paint (2023)

Quantum dots are electricity-generating nanoparticles. Mixed into coatings, they result in paintable solar cells. With this solar paint, every wall of a house becomes an electric generator – even without solar cells. Researchers at both the University of Notre Dame (USA) and the University of Toronto (Canada) are working intensively on this project.[34]

3.2 Distribution

#20 Cable as power pack (2021)

What would it be like if your shirt were a charger for your mobile phone? Researchers at the University of Central Florida have developed a cable that stores electricity. If the cable is wound into fibre or into textiles, any piece of clothing becomes a battery – and electricity no longer comes "out of the socket" but out of the boutique. Fashion stores will become energy producers.[35]

#23 Wireless power (2019)

The first successful results with the transmission of electricity through the air has been demonstrated with the "cota" system from the start-up Ossia. The system transmits energy over a distance of up to ten meters with the spectrum of waves that wi-fi, Bluetooth and ZigBee use. The energy transmission has even been successful in tests where the recipient was not within the broadcaster's range of vision.[36]

3.3 Storage

#28 Salt as storage battery (2017)

Significantly cheaper than modern batteries: Energy melts a smelting salt that is stored until the next power consumption peak. Heat exchangers draw the energy out of the salt and convert it to electricity.[37]

#31 Electricity from wood (2022)

Researchers from the University of Maryland (USA) have coated wooden fibres with tin and placed them in a sodium solution. The prototype withstood 400 charging cycles (sodium costs less than lithium). The battery could store large amounts of energy – for instance, for solar farms.[38]

3.4 Consumption

#33 Glow-worm electricity (2025)

With the aid of bioluminescence, glow-worms convert 95 percent of the applied energy into light, five percent into heat. Not even modern LEDs manage that. Therefore, researchers are attempting to develop biological street lighting by transferring the genes from the glow-worms to trees.[39]

#38 Heat from the wall

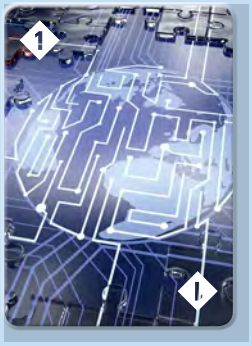
Innovative sheetrock panels could reduce heating costs in buildings with conventional walls by up to 40 percent. Half of the plaster in the panels is replaced by paraffin pearls. These absorb the heat during the day and release it during the night.[40]

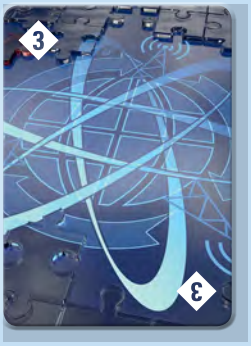
33 DIE WELT (2014)
34 Kamat, P.V. (2013)
35 University of Central Florida (2014)
36 Etherington, D. (2013)
37 Woody, T. (2012)
38 Bora, K. (2013)
39 Griffiths, S. (2014)
40 Coxworth, B. (2012)

4 Wildcards
Thinking outside the box

"Plausible impossibilities should be preferred over implausible ways."
Aristotle (384–322 BC)

The previously outlined scenarios deal with the conceivable future. However, what about the unavoidable and perhaps unwelcome surprises of the future? So-called "wildcards" are a good way to illustrate these situations. They describe the events or developments that appear to be highly unlikely at first glance. If they were to occur, they would have a revolutionary impact on the energy sector. Wildcards can be positive or negative in nature – depending on the eyes of the beholder.





4.1 Wildcard "CO_2 as raw material"

Carbon dioxide is generally referred to as a greenhouse gas, the emission of which should be reduced. Hardly anyone thinks of it as a raw material. However, hundreds of millions of dollars are currently being spent on the development of technologies to use CO_2 for manufacturing processes; for example, for plastics, fuels, cement or methane.[41] Currently, not all the technologies developed are feasible for manufacturing processes. With the aid of these new methods, coal-powered power plants with carbon capture and storage (CCS) could become one of the cleanest types of energy production – as long as the gas is immediately bound and used. Should this development be successful, it would be *the* revolution in the energy sector and a basic shift in the complete energy and eco-balance.

4.2 Wildcard "Attacks on energy infrastructure"

Electricity grids will be transformed into smart grids in the coming decades. These smart grids will practically operate themselves with highly developed control technology. According to predictions, between 50 and 75 billion intelligent appliances will be connected to the Internet of Things by the year 2020.[42] That also means that the entire infrastructure of the world could be paralysed by cyber attacks – a true dystopia.

4.3 Wildcard "Clean nuclear power"

No other raw material in the energy industry offers such a high yield per unit of mass and density of performance as nuclear power – it just isn't "clean" when it comes to waste. For this reason, Bill Gates is investing in the travelling wave reactor.[43] Such a reactor burns the waste from "normal" nuclear reactors and transforms it into energy. Should this or a comparable technology assert itself, nuclear energy would suddenly be considered differently by politicians and society and it could enjoy a renaissance.

41 Tieman, R. (2013)
42 Danova, T. (2013)
43 Gillis, J. (2013); Bullis, K. (2011)

4.4 Wildcard "The quantum computer"

A quantum computer, in contrast to conventional computers, does not work with digital technology, but according to the laws of quantum physics. It would only require seconds to solve a problem that a normal computer would require years for.[44] With a quantum computer, smart grids could become super smart and enormous efficiency reserves released which – with constant electrical consumption – potentially makes many power plants superfluous. However, quantum technology requires a great deal of energy.

4.5 Wildcard "Contour crafting"

The annual restoration rate of real estate in the OECD countries is about one percent.[45] The restoration itself, however, frequently leads to a significant improvement in the energy efficiency and generally continues for a long time.

Contour crafting could provide a solution for the future; old walls are simply torn down and replaced by a new building from a 3D printer within 24 hours.[46] Such a building saves 60 percent of the construction costs compared to conventional building methods – without construction waste and in record time. In addition, the strength and resistance of the printed walls is much greater than traditional walls. Should contour crafting become feasible, the rate of new construction can be expected to explode – and the energy consumption of homes will significantly decrease.

4.6 Wildcard "The super battery"

There is no such thing as super storage – not yet. However, because research in this field is rapidly advancing, it would be unwise to assume that there will not be revolutionary results in the near future. Revolution also means disruption. Future-competent managers already diversify their research budgets and pilot projects today, keep an eye on study results and keep their innovation radars focused. After all, the breakthrough in storage technology may come from another field entirely.[47]

44 Markoff, J. (2014)
45 IEA (2013)
46 University of Southern California (2014)
47 Halper, E. (2013)

5 Strategic Implications
Shaping the future

"Drill for oil? You mean drill into the ground and try to find oil? You are crazy!"
Driller before the first oil drilling project (1859)

The greatest challenge of futures management is not the prognosis of market developments. It is much more a matter of answering the question: What do the impending opportunities and risks of the individual scenarios mean for own business strategy? Here are some ideas to point the way:

5.1 Simplicity: the new paradigm

Don't try to conduct futures management on your own. Form strategic alliances with scientific backing.

Not only are the scope or competence of your exertion of influence decisive for the impact and efficacy of your communication; more important is the simplicity of communication.

It is not the better product that wins in the market, but the product that is communicated in the most intuitive and simplest manner – both verbally as well as visually (with its design). As Marshall McLuhan put it: "The medium is the message."[48]

Without massive simplicity offensives, there is a danger that corporations from outside the energy industry will run away with the business. The IT industry has long applied marketable and successful simplicity in terms of strategy, design, communication, product and marketing cultivation.

In the future, the focus will no longer (solely) be on supplying people with energy, but on reaching out to them with simple messages, programmes, concepts, products and services.

Example Customers can change their energy provider easily and automatically. The new electricity supplier offers an exclusive service for this and takes care of the cancellation and transfer of supply.

5.2 Diversity: the key to transformation

The signs of the times are clear; industry boundaries are collapsing. A convergence of industries is resulting, for example, Apple and Ferrari cooperate or Facebook plans money transfer solutions for members.

Therefore, a successful futures manager has to be familiar with as many other industries as possible. To accomplish this, the energy sector first needs to implement entry programmes in order to become attractive to managers and employees.

These development programmes for generating diversity function according to the method and design of "NetEducation": Work and train together – across departments, companies and industry boundaries – according to the principles of a "NetAcademy" rather than a "Corporate Academy".[49] The transformation, which is so urgently needed for the strategic changes required in the energy sector, is only possible with such a comprehensive method.

Example Google takes over wind parks or E.ON operates a lifestyle online shop through a subsidiary.

5.3 Innovation: the lever of progress

Promising innovations are no longer the exclusive task of research and development. They have become a complex integrative process with many new players. The strategy for this is increasingly developing in the direction of open innovation.

In the age of apps, the services around the actual product are becoming ever more important to the consumer. Thus, innovation can no longer concentrate simply on products and technologies.

48 McLuhan, M. (1964)
49 von der Gracht, H./Gaiziunas-Jahns, N. (2014)

For this expansion of innovation, companies require professional new service development (NSD) and service engineering.

Unconventional thinkers have proven to be best suited for creating the energy miracles being sought; innovation advantages can be accomplished with new approaches and methods.

Example In the future, customers will be able to monitor and control their energy consumption using an app on their smartphone.

5.4 Employer branding: the foundation of attractiveness

Although changes in the energy sector are considered to be equally desirable and necessary and recommendable by citizens, associations, politicians and the media alike, paradoxically this does not necessarily translate into a positive image of the industry as an employer. The difficult implications for HR management, in times when finding qualified employees is already hard, are obvious today, and will become even more challenging in the future. A clear corporate as well as industry image campaign is recommended to counteract this – combined with increased use of social networks.

Regionalisation of communication can also be a suitable means to create a strong employer brand for the specific area.

Branding and communication concepts, as well as funding for their implementation, are required. Above all, experts should be hired to promote and advance these concepts.

Example Due to its withdrawal from nuclear energy and positioning as a "green company", Siemens Wind Power was voted the most popular employer by engineering students in Denmark: a country that is very critical of nuclear power.

5.5 Communication: the key task for the future

Good products are no longer enough. Today, effective communication is decisive. Information events held in advance or during investment projects are now refuted by the media. Their communication structure no longer satisfies the demands of participants.

Participation is demanded instead of information: concepts, events, moderators and experts on site should therefore adapt to the changing requirements with appropriate new concepts.

The corporate communication of the future should provide the public with precise content instead of abstract advertising jingles, role models instead of actors, educational parables instead of product advertising and sustainable messages instead of simple slogans.

Successful energy companies of the future will dedicate themselves to the identification, selection and development of "remarkable people" in order to generate the necessary awareness and sense of reliability among the public that the energy industry needs. These changes oblige managers to acquire the necessary transformation competence.

Example The largest percentage of advertising expenses in the energy sector today is invested in image campaigns. EnBW, for instance, positions itself as a climate-friendly energy provider with the slogan: "We save the most CO_2. Promise".

6 Conclusion

"Just thinking does not accomplish anything; only purpose-oriented and critical thinking does."
Aristotle (384–322 BC)

What if the world would have unlimited energy as of tomorrow? The dream of energy without limits is just that: a dream, similar to the utopian dream of eternal life or the land of plenty. However, the reality of the energy industry looks quite different, both now and in the future.

The future means work. The future doesn't just "happen" by itself, the future has to be worked on, developed. The instruments and methods required for this type of work have already been outlined in this study: scenarios, wildcards, trends and the prevention of cognitive distortions. These techniques and tools are already known to every modern company in the industry today. The crux of the matter, however, is this: Most of these methodologies are only known to the few individuals responsible for foresight in that company. If one of these individuals leaves that company, the futures expertise leaves with them.

It is precisely for this reason that strategically-minded managers have learned to transform their knowledge into a culture. In this way, what was once a limited and very isolated application of futures technologies is transformed into a modern futures culture that is integrated into all meetings, projects and decision-making processes. What can often be the key to success is notoriously underestimated in scope and cost – as with every significant cultural change.

To successfully achieve such a radical change in culture, managers and employees have to be trained not only in the theory of the techniques that will be used, but also in their actual application, for example with pilot projects, process support or coaching. And although the challenge may at first appear daunting, the sheer scale of the energy revolution that is happening in society and politics demands this size of effort in response to it. It will, after all, be rewarded in the end by increased transparency, improved competence and future security.

If there is one thing that characterises the industry, it is the jungle of intransparency in which these dynamics operate. This seemingly impenetrable darkness can in fact be thinned out by the application of proven, trained and comprehensively applied futures management. A futures management that not only has the necessary methodological skills, but also the organisational support and learning culture underpinning it to enable the company to not only survive, but thrive in turbulent times. The energy industry needs futures management. Now and in the future.

Methodology

"Man must persist in the belief that the incomprehensible is understandable: otherwise, he would not conduct research."
Johann Wolfgang von Goethe (1749–1832)

This is not a traditional study in the sense of surveying the opinions of a representative section of a population. Futures research more often involves scenario setting, applying plausible assumptions and a deeper analysis of cause-and-effect relationships rather than gathering opinions. All three of these methods can be more reliably ascertained by employing specific expert knowledge instead of surveying opinions.

Thus, this study is mainly based on the comprehensive sector expertise of KPMG professionals in collaboration with the Institute of Corporate Education e. V. (incore), which contributed its competence in scientific methods and knowl-edge of trends and futurology.

A core team of five scenario experts worked on bringing together valuable inputs from numerous expert discussions, workshops and an extensive literature review. More than 100 futures and scenario studies were identified and evaluated, of which approximately a third involved the energy sector.

The literature review was a key factor in ensuring that this study provided demonstrable and practical added value to the energy sector. Readers are not only able to experience the entire process of foresight in the various sections of the study, but the techniques described and referenced can be taken and implemented at any time in any company, thus helping managers to learn about and apply strategic forecasting in a practical and pragmatic way.

The three phases of foresight were introduced to the reader as follows:

1. **Scanning (environment analysis, uncertainties)**
   In addition to the experience of the core team and the extensive literature review, focus research and trend databases were used, for example: iKnow, Shaping Tomorrow, TechCast, TrendONE.

2. **Foresight (scenarios, trends, wildcards)**
   In this phase, the focus was not only on what is considered to be a probability for the future (as commonly seen in other publications) but rather on several levels of the future. According to the current view of the World Future Society, we explore the „3P plus 1W": the Probable, the Preferable, Possible futures and W for wildcards.

3. **Transfer (implications, biases)**
   The emphasis here was on the empowerment of management. To explore this, not only were the strategic implications of the study worked on in a number of practically-focused workshops, but also – a first in scenario and futures studies – biases, or a wide range of thought and perceptions involved in the transfer process, were identified.

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We look forward to continuing the discussion with you!

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