Chapter 1. Reconfiguring the energy world

The energy world has undergone significant changes over the past few years, a trend that is reflected in the popularisation of the “energy transition” concept. A number of items relating to this phenomenon appear in the media on a daily basis, including renewable energy and energy savings; however, these are only a few aspects within a much broader framework.

Is there no way out of the energy crisis?

Current power supply systems pose serious problems due to their unequal distribution and the fact that they are not shared properly. Another factor is power wastage: in developed countries, energy consumption could be reduced by 20 to 30%.

Access to electricity remains a global issue; over 1.4 billion people lacked access to electricity in 2010.

Are we running out of inspiration to innovate?

Technology's capacity to revolutionize lifestyles is raising doubts. As Peter Thiel said in 2010, “We wanted flying cars, and we got 140 characters.” Furthermore, as Robert J. Gordon wrote in 2012, “For more than a century, the US economy grew robustly thanks to big inventions; those days are gone.” He believed the decline to be due to the contraction in labour productivity growth, which fell from 2.33% in 1891-1972 to 1.30% in 1976-1996 and 2004-2012 due to a lack of innovation, while the period of acceleration between 1996 and 2004 was due to the “new economy”, which corresponded to productivity growth of 2.46%.

… or are we on the brink of a fundamental breakthrough?

According to experts, the third industrial revolution will rely on digital tools. From an optimistic standpoint, we are apparently on the cusp of an era of infinite progress, thanks to the boom in smart technologies. Although this statement may be premature, the Internet revolution did not stop in 2004, but instead is spreading to the energy sector.

We can therefore argue that the current situation offers new development prospects, through adapting a power supply system that has its origins in the Industrial Revolution.

Digital provides customized, interactive and tailor-made energy

Although Web 2.0 describes the way in which digital life has become decentralized and has been distributed and shared, Web 3.0 marks the beginning of customizing “limitless” usages in a ubiquitous universe, which now leads us to describe the ongoing transformation in the energy sector as “Energy 3.0”.

Consumers will not only be able to generate power, but will also be able to share it and use it in a “tailor-made”, efficient way thanks to a large number of innovations that are bringing the digital and energy sectors together. These include building consumption management software, smart objects (temperature or air quality sensors, engines, robots, etc.), smart meters and variable colour and intensity LED lighting.

Chapter 2. Upgrading the energy system of cities and regions

The old centralized energy transmission and supply model, which was inherited from the late 19th Century and was called into question following the liberal watershed of the 1980s and 1990s, is currently converging with a decentralized model based on power-sharing and power-generating buildings. This transformation, which enables tailor-made power to be generated for different regions depending on weather conditions, energy prices, and their resident's requirements, makes the development of a wide range of services at the city level possible, regardless of whether that city is green, sustainable or smart.

An increasingly vulnerable and inadequate infrastructure

The current centralized system suffers from a number of faults, including substantial energy losses (fraud, meter errors and the Joule effect), recurring centralized network breakdowns (like the breakdown on 4 September 2006, which deprived around 15 million European users of electricity for an hour), the

legal and functional separation of network management, and a lack of flexibility when responding to fluctuations in supply and demand. This situation is further compounded by increasing reticence among the general public where building major power generation infrastructure is concerned, due to its negative impact on the environment.

Smart grids, at the heart of a new energy management model

Alongside this crisis in conventional power supply systems, the boom in positive energy buildings, the development of renewable energy, and its interconnection at the local level are making it possible to share and decentralize our power supply system. To achieve this aim, substantial investment must be made in two areas: first, a massive installation program for smart metering and consumption management systems (primarily smart meters, which enable the demand for power to be optimized, and consumption to be calibrated as closely as possible); and second, developing the network in order to incorporate and promote renewable energy (introduction of computerized tools that enable us to be informed about power generation on a minute-by-minute basis, and to draw up forecasts for power generation and the development of new storage facilities).

Far from replacing the centralized system, which will continue to supply users with a stable electrical current, this new

decentralized ecosystem will coexist with it. This means that the decentralized system will enable the needs of the local loop to be met, and any excess power generated or that it has managed to store will be fed into the network during peak demand periods.

New smart and sustainable urban solutions

Cities will be the focal point of this hybridization between centralized and decentralized systems. They will become capable of deciding to generate, store and consume power in real-time, as and when they require it. This environment opens up a range of urban services that are made possible by technological innovations, like smart lighting and applications for smart phones or chips that deliver real-time information on traffic conditions. The main driver for these innovations will be their simplicity of use, installation and maintenance. They will emerge from the convergence of multiple skills, primarily in the energy, finance, infrastructure, software, and personal service sectors.

Chapter 3. Optimizing energy management in homes and buildings

The building sector: a very high energy consumer

In developed countries, residential and commercial buildings account for the highest expenditure in terms of power consumption, ahead of industrial activities. The energy efficiency of buildings therefore represents a major catalyst for energy savings, in an environment where tensions surrounding the issue of resources are constantly increasing. Nonetheless there is still much to do in this area.

The limits of the passive energy-efficiency approach

From the regulatory standpoint, most current approaches focus on the building as a casing that must be more tightly sealed. In fact, combating energy losses in buildings, primarily in the form of heat, enables relatively significant energy savings to

be made. However, this approach has its limits: it often generalizes phenomena in a sector where the diversity of situations is key, and above all forgets to take account of a crucial factor, namely how the building's residents behave.

The building as a decentralized energy unit

A building is not just an “envelope”: it is an ecosystem of objects that can generate power and/or supply services to its occupants. We must no longer approach buildings solely as units that receive power, but as units that consume and even generate power in order to understand this feature. In fact, the use of power generation technologies (solar powered heating, solar power, heat pumps, etc.), and of more efficient appliances provides a viable source of energy savings.

Active energy efficiency in order to promote diversity

As an environment that provides services to its occupants, a building has everything to gain in terms of energy efficiency from the new opportunities offered by mastering digital technologies. Through the systematisation and automation of tools and sensors for measuring, metering and displaying the services provided and their power consumption, we can improve

a building's performance over the long term by positively influencing its users' behaviour and by adapting management solutions for each specific area and period.

Energy efficiency as a way of improving quality of life

Aside from the environmental and economic aspects, a building that has become an intelligent ecosystem opens up a world of customized services aimed at improving the well-being and quality of life of its occupants, through the automation of tiresome tasks, increased security, and control over the environment quality.

Chapter 4. Energy 3.0: addressing the most fundamental challenges of the energy transformation

Energy: an increasingly expensive resource

One of the main issues hiding behind the importance of thinking about energy efficiency is the issue of balancing security of supply with the cost of energy and environmental standards and requirements. According to these three factors, the cost of energy resources is likely to increase, in terms of scarcity of resources and their market price, as well as of eco-taxation.

Energy efficiency: energy savings

In fact, now more than ever before, it seems that the cheapest power is the power that we do not consume. Active energy efficiency methods offer solutions in this field, both in terms of consumption incentives (combating the rebound effect, lower investments, a faster return on investment, etc.) and of stimulating the construction market (renovating the existing

building stock and reviving construction based on the “low consumption” or “positive energy” model).

Energy efficiency: improving quality of life

However, energy savings are only one of the benefits provided by the Energy 3.0 solutions. In fact, these solutions offer opportunities in terms of quality of life and comfort, not only through more effective measures to reduce greenhouse gas emissions (both in the construction and industrial sectors), but also through combating fuel poverty (which affected 10-25% of the European population in 2009 according to the European Fuel Poverty and Energy Efficiency (EPEE) Project) by providing solutions for reducing energy bills.

Energy 3.0 as a focal point for renewed growth

Specifically, the Energy 3.0 revolution can provide a new impetus to economies affected by the economic and financial crisis, by promoting growth and employment in various sectors including the construction, building renovation, and recycling sectors, as well as the renewable energy sector. All these sectors offer attractive future prospects, both for reinvigorating existing markets and for developing new markets and approaches, primarily through introducing sustainability – in the

environmental and responsible meaning of the term – via the concept of the circular economy.

An energy paradox that calls for a change in practices

Although these solutions are promising, they mainly rely on existing techniques and technologies which are currently colliding with what economists call the “energy paradox” or the “energy efficiency gap”: the insufficient adoption rate of energy-saving technologies despite their profitability. This paradox owes its existence to various regulatory and timing obstacles (the adoption cycle for an energy revolution of this kind is relatively long by nature), which call for a genuine focus on new governance methods that are appropriate for the ongoing energy transition.

Chapter 5. Energy 3.0: adapting governance to facilitate the energy transformation

Methods for promoting the rise of Energy 3.0

Various players are involved in the energy transition process, including the Government, local authorities and "governance bodies". We can identify three main desirable methods for promoting the rise in new technologies and their use: 1. A commitment in the form of targeted economic interventions; 2. Contributions to the development of technological innovation ecosystems; and 3. Invention of new financing models.

The resources required for establishing a stable legal framework

The essential role of public authorities is to promote frameworks and standards that allow more inter-operability between players in the sector. For instance, one of the challenges for the future of Energy 3.0 is the development of communication protocols for connected objects.

The measures are also likely to focus on applications intended for consumer-users. The underlying goal is actually to involve these consumer-users in the energy transition process, by making them aware that taking part in these changes is in their interest. For instance, building insulation works on the rental market are currently encountering a number of obstacles that need to be overcome. The interests of landlords and tenants could be mutually beneficial rather than destructive if there was a coordinated intervention process.

Economic and financial framework

On a more global scale, it now appears necessary to redirect public investments in the energy R&D field. At present, OECD data show a mismatch between the treatment reserved for energy efficiency industries and that of fossil fuels, given that these two activities have respectively received public grants of €38 billion and €500 billion.

New kinds of financing could fund the energy transition. In this respect, stronger action by the European Investment Bank (EIB), primarily in terms of coordinating European funding, would provide part of the answer.

From a more practical standpoint, initiatives that are found in several European Union countries deserve to be expanded, including the Energy Performance Contract and the Energy Savings Certificate. A reform of subsidy and tax optimization

systems, as well as a new wave of energy entrepreneurs, would provide support for a genuine energy revolution.

Chapter 6. Energy 3.0: developing end-user-driven business models to advance the energy transformation

The energy paradox phenomenon

The energy transition process' development is currently running up against what economists call the “energy paradox”: a process for the dissemination of technologies in society that is characterized by its slowness, despite their profitability. To make the new offerings more accessible and attractive, new business models guaranteeing better dissemination of techniques will need to be designed.

Moving towards a knowledge-based economy

The solution is likely to be based on a human-scale energy model that focuses on the user's experience. More specifically, the aim is to bet on intelligent systems in order to develop high value-added energy services which meet users' requirements. In fact, we could be watching a knowledge-based economy emerge. In future, requirements will be increasingly met by new products

that will be neither goods nor services, but “life solutions” consisting of the temporary availability of information, goods or people.

Products and services tailored to users

This economic paradigm shift corresponds to what Jeremy Rifkin describes in his book, The Age of Access, when he talks about “switching from a propertied regime, based on the idea of broadly distributed ownership, to an access regime, based on securing short-term limited use of assets.” Due to the effect of these changes, the solutions proposed will take the form of “customized products and services” that are based on the principles of the shared economy and recurrent income. This is the key to the Energy 3.0 concept, which specifically describes “this personalized aggregation of consumer-driven products and services.”

We can identify three models that these new products and services could adopt: aggregation models, service models, and local consumption, exchange, transfer and storage models.

Chapter 7. Energy 3.0 : Reinventing the energy sector to make the energy transformation a reality

In view of the European Union's ambitious targets, and due to the increasing scarcity of resources, businesses in the sector, which includes electrical equipment manufacturers as well as distributors and installers, will become strategic areas in tomorrow's global economy. Professionals will need to focus on four business areas to ensure that this happens:

- Initiating and disseminating innovations
- Promoting the services provided to clients
- Broadening their expertise
- Increasing and promoting the sustainability of energy efficiency initiatives

Overview of and outlook for the eco-electricity sector

The Rexel Group, which has carried out studies on this issue, now understands the main drivers for adopting these technologies. The choice of potential users is primarily

determined on the basis of the return on investment, and of the level of effort and risk involved.

To meet these expectations, we need to envisage partnerships and cooperation mechanisms between the main players. It is up to companies to “accelerate and ensure the implementation of new profitable solutions, and to create an ecosystem that simplifies interconnections.” The success of the energy transition process and the dissemination of innovations will involve an approach that is open to technologies, along with a collaborative stance that is similar to the spirit of a start-up.

Another condition for the industry's success is this “need for compatibility” between solutions, which we can compare to the need that resulted in the extraordinary development of digital technologies. Although “totally open systems” do not work in reality, the classifications below distinguish between three alternative systems among which a choice will probably have to be made:

- Free solutions that give free rein to the creativity of communities of developers
- Interconnecting solutions between proprietary systems, i.e. bridges between different manufacturers' systems
- Closed solutions that include the possibility of downstream interventions by independent developers

Advice for professionals

Regardless of the inter-operability solution selected, the only way of ensuring that the industry will meet its customers' expectations will be to succeed in “integrating granularity and scalability”, in other words, combining the ability to provide local and customized solutions with a consistent offering that will reassure the user. Rexel holds advantages where adopting such a positioning is concerned, primarily due to its support functions around the world.

Furthermore, in practice we observe that financial obstacles remain the main hindrance as far as adopting energy-efficiency solutions is concerned. To solve this problem, it is important to confirm the ability of these solutions to generate value for consumer-users. To preserve that value, however, we will need to broaden the scope of intervention and expertise of installers and distributors, while simplifying the processes and investing in training.

Chapter 8. Energy 3.0: accelerating the energy transformation

By using the concept of Energy 3.0, Rudy Provoost wanted to emphasize a dimension that currently appears not to have been sufficiently factored in, and which can be summarized in one sentence: consumers must control their power. The generation and consumption of that power will increasingly be optimized, customized and tailor-made. There will be no more wastage, and the power will suit the need, i.e. lighting, heating and air conditioning systems will be turned off or lowered when you leave. Conversely, the systems will be customizable for each room and for each function when you are there, i.e. simulating dawn when you wake up, bright colours for a party, and lit-up paths at night. This control over the power supply involves interactive interfaces that enable everyone to design their consumption scenarios. For instance, a junior high school headmaster can optimize the energy expenditure in each classroom according to the lesson timetable. These management systems can be accessed regardless of the terminal used – computer, tablet or smart phone – thereby granting everyone real-time access to their own energy world. This new world is simple, open, scalable, and has no limits.

Energy 3.0: creating a world of energy, tailored and designed around the end-user

To sum up, all the key drivers for the energy sector are converging from a model that we could call “Energy 1.0” to a model known as “Energy 3.0”. The market model is gradually becoming more decentralized before being ultimately customized depending on the customer. In value chain terms, although power generation was once the predominant factor, experience and all the uses and behaviours of the end client are increasingly becoming key within the holistic context of the private and public environment. The trend is similar for the dissemination of information or communications between the consumer and the energy infrastructure.

The “Energ-eas-y” revolution

At this stage it is necessary to design mechanisms that enable complexity to be reduced at all levels, including generation, supply and consumption, in order to create a favourable environment for the energy transition process. To insist on this concept of simplicity, Rudy Provoost called it “Energ-eas-y”. The concept involves all the players in the energy value chain: Governments and local authorities, energy generators and suppliers, electrical product manufacturers, and other players positioned on the value chain including installers, computer service companies, telecoms operators, players in the digital world, and insurance companies.

Energy 3.0: Empowering the end-user to make the energy transformation a reality

How can we enable the end-client to take control of their power? This empowerment is based on two concepts: first, a sense of responsibility, especially where climate change is concerned; we are appealing to every individual's ethics. The second concept is that of control which is more hands-on, and involves “fair” energy, an increase in purchasing power, improved quality of life, economic growth that creates jobs, and the accelerated adoption of new technologies. The empowerment of the end-client will provide hands-on benefits over the coming years, all of which are discussed in this final chapter.