

CHAPTER 5

Global game changer – leading the future

The final chapter summarises the governance principles, from the country chapters, and the core competencies, drawing on the experiences of the new business model case examples, which are necessary to further accelerate the transition to a decentralised energy system.

5.1 Six reasons for decentralisation as the key driver of the global energy transformation

The energy system is undergoing radical change with decentralised renewables as a key driver due to the following trends:

- (1) **The increasing competitiveness of renewable energy generation in liberalised markets – meeting grid parity and heading towards energy system parity:** renewable energies have attracted major investments in industrialised countries with an established and reliable energy system. As costs have fallen, the motivation to install solar and wind power units in these countries has shifted from publicly sponsored incentive schemes to grid parity and attractive financing models even without subsidies and government aid.
- (2) **The global spread of decentralised energy generation:** since 2010, cumulative investment in distributed capacity has been around US\$400 billion, moving energy supply onto rooftops and smaller acreages. Not only is this provision of services, but in countries such as Germany, Italy, or Australia community-owned initiatives have also become engaged in ownership or operation of grid infrastructure.
- (3) **Decentralised storage gaining importance:** storage via batteries is a key technology to increase flexibility and adapt the energy supply system to intermittent renewable generation. Advances in storage

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technologies are speeding up with the race of global car manufacturers to electrify the transport sector, and prices for lithium-ion batteries have decreased by 18 per cent between 2017 and 2018.

- (4) **Decoupling growth and energy intensity via renewables and energy efficiency:** the energy intensity of the global economy is improving due to technological progress and systemic changes. Despite rising GDPs in many countries, including China, energy consumption per unit of economic output are stable or falling, also because of structural changes in their economies – with less reliance on energy-intensive industries and a shift to services and digital production.
- (5) **Value creation with decentralised renewable energy generation:** renewable energies, in particular solar and wind, not only account for an increasing share of employment in the manufacturing of these technologies, but also in local value creation – either in construction and installation, or in operation and maintenance. Especially in countries in the developing world, renewable energies are drivers for local employment and value creation.
- (6) **Digitalisation as an enabler of disruptive changes in energy markets:** the core competency that all industries are currently establishing is expertise in digitalisation – be it with artificial intelligence, the remote operating centres, or blockchain-based peer-to-peer platforms – digitalisation lowers barriers to entry for start-ups and facilitates new business models, increases customer choice, and is the necessary precondition for decentralised transactions.

5.2 Preparing for the three phases of the energy transformation: the 8+3+6 model

Three phases in moving from the conventional, fossil fuel-based supply structure to a decentralised, renewable system can be observed. As outlined in Section 3.1 and Chapter 4, Phase I can be associated with a niche deployment of decentralised renewable energies, contributing less than 10 per cent to total power generation. In Phase II, their contribution to total power generation amounts up to 40 per cent and becomes a major factor in the supply portfolio, whereas Phase III is characterised by decentralised renewable energies as the dominant player within a flexibly operated system with an increasing number of fully autonomous solutions not connected to a central grid.

Political and economic decision makers can prepare for the different phases of the energy transformation by thinking from Phase III (Energiewende 3.0) backwards to leapfrog or to allow the three energy phases to co-exist.

Based on the analysis of the country reports, the following eight recommendations for regulation and governance have been derived.

5.2.1 Regulation and governance: eight key principles for political decision makers

- (1) **Transparency and legitimate policymaking and institutions**
The governance system needs to be able to offer clear policies and regulation that applies simultaneously to large and decentralised generation and public and private sector actors.
- (2) **Availability and transparency of data**
Transparency of the system needs to enable all stakeholders to engage in the way in which the system is operated and, as the system digitalises, have access to affordable and secure data.
- (3) **Customer focus, enabling customer choice**
People will affect the future energy system in three areas – as investors and operators, as willing participants and as customers who pay for innovative products that enhance their quality of life, and as voting supporters of policies and measures that deliver decarbonisation.
- (4) **Markets to encourage flexibility in supply and demand**
The least expensive solution to increase flexibility and efficiency during the transformation is demand-side response. As a platform model, it does not require an expensive supply infrastructure but builds on existing assets, exploits their flexibility potential, enables peak-shaving and thus brings down peak costs.
- (5) **Local system coordinators and a coexistence of the central grid and decentralised micro-grids**
Access to payments for flexibility services will be key to enable the production of power from solar and wind to be efficiently integrated into the system. This requires a more active role for regional operators of the distribution system and a greater focus on a bottom-up approach to system operation.
- (6) **Including performance-based elements into sector governance**
The new regulatory framework should be based on performance rather than cost-of-service. Performance-based regulation defines desired outputs and then establishes an incentive mechanism whereby the utility or company is paid to the extent it delivers the desired outputs, as opposed to cost-of-service regulation. Inputs may change provided the desired outcomes are met, which means that there will be more flexibility of choice in delivering those outputs rather than being locked into the inputs.
- (7) **Reassessing investments in the long-distance transmission grid**
If a country starts adding decentralised renewables in combination with cheaper flexibility resources, then expensive networks upgrades may not be required and reliability problems may be less relevant, thereby keeping a cap on infrastructure cost increases.

(8) An integrative approach to sector regulation

Ambition-driven regulation does not only ensure supply and balancing obligations are met, but wider social and environmental goals are delivered along a pre-agreed timeline. As the energy system decarbonises and decentralises, the convergence of heat, mobility and power on the distribution level requires coordinated regulatory instruments and actions. Regulators have to be flexible to establish new processes and encourage innovation across sectors.

5.2.2 Business models: three business models plus six core competencies for corporate decision makers

The real ‘global game changer’ related to the energy transformation is that many of the new technologies are modular and deliver services for individuals or communities at the distribution level, as well as at transmission grid scale. Electricity supply diverges from the previous model of central generating units and heads towards decentralised installations, from public ownership and large corporate entities who control the assets to a dispersed and fragmented ownership structure, often dominated by private individuals, such as homeowners, farmers, or energy associations. Corporate leaders can prepare their companies for the different phases of the energy transformation by thinking from Energiewende 3.0 backwards, preparing for the new business models via

- (1) **New asset ownership models:** the infrastructure of electricity supply requires capital-intensive investments up front to establish transmission lines, generation plants and transformers, metering devices at the final users’ residences, data and billing centres, and many more technical features. The rise of decentralised energy fundamentally changes ownership structures. By incentivising PV installations with feed-in tariffs, homeowners, farmers, and energy cooperatives are encouraged to install PV panels or wind turbines. Ownership of power-generating assets has become a mass-market phenomenon – both in developing and in industrialised countries. Financing these capital-intensive investments has moved from traditional methods with credits to crowdfunding, partial ownership via energy associations, and – most lately – initial coin offerings and cryptocurrencies.
- (2) **New service and operating models:** business models based on efficiency services and the optimisation of the operation of energy assets – including the equipment of dwellings, such as lighting and windows – require in-depth knowledge of the complex interplay of all the energy-related components of each object. With the use of practically unlimited computing power and artificial intelligence algorithms, the barriers to entry in this field have been significantly reduced, and

new players can more quickly and easily access the market than before. Service models that include complementary convenience factors, such as safety and security features of private residencies, or allowing for assisted living, are likely to succeed in the marketplace.

- (3) **New platform models:** digitalisation and the decentralised attributes of the energy transformation enhance platform models because of their low asset-intensity. Individual small-scale assets are bundled into virtual power plants to sell electricity en gross, for example on the wholesale market. Platforms are not limited to generation units. They can also integrate demand-side management for peak-shaving or ancillary grid services such as balancing energy. Aggregators open platforms and decentralised peer-to-peer trading marketplaces based on decentralised ledger technologies, such as Ethereum, and future reliability will be resolved via localised optimisation and balancing of decentralised, regional hubs.

Based on the analysis of the business cases, six core competencies for companies to develop have been identified:

- (1) **Digitalisation**

All industries are currently establishing expertise in digitalisation – a theme that is present in all interviews – be it remote operating centres, blockchain-based applications, or digital sales channels. Data management will be a key driver for commercial success; the use of Artificial Intelligence for data analytics and smart customer interaction will give a competitive edge to those companies who embrace these new machine learning tools.

- (2) **Customer centricity**

At the core of the business models that trigger and accompany the transformation will be the customer. Utilities, start-ups and new entrants from other industries will offer services and value propositions that suit each customer segment. It may not be customer centricity *per se*, but rather finding the *balance* between listening to users while ensuring a high degree of standardisation. Customer centricity comes at a price, and the core competency required is to drive costs down by developing new forms of mass customisation.

- (3) **Financing and enabling of asset ownership**

Companies have developed diverse strategies for how they can help prosumers to finance decentralised generation assets. Especially in developing countries, the major hurdle of a large upfront investment has been removed; in rural settings, residential owners of rooftop solar systems can generate additional revenues to repay their debts. Moreover, financial competencies stretch into the sphere of cryptocurrencies: Start-ups enable peer-to-peer transactions with virtual currencies and

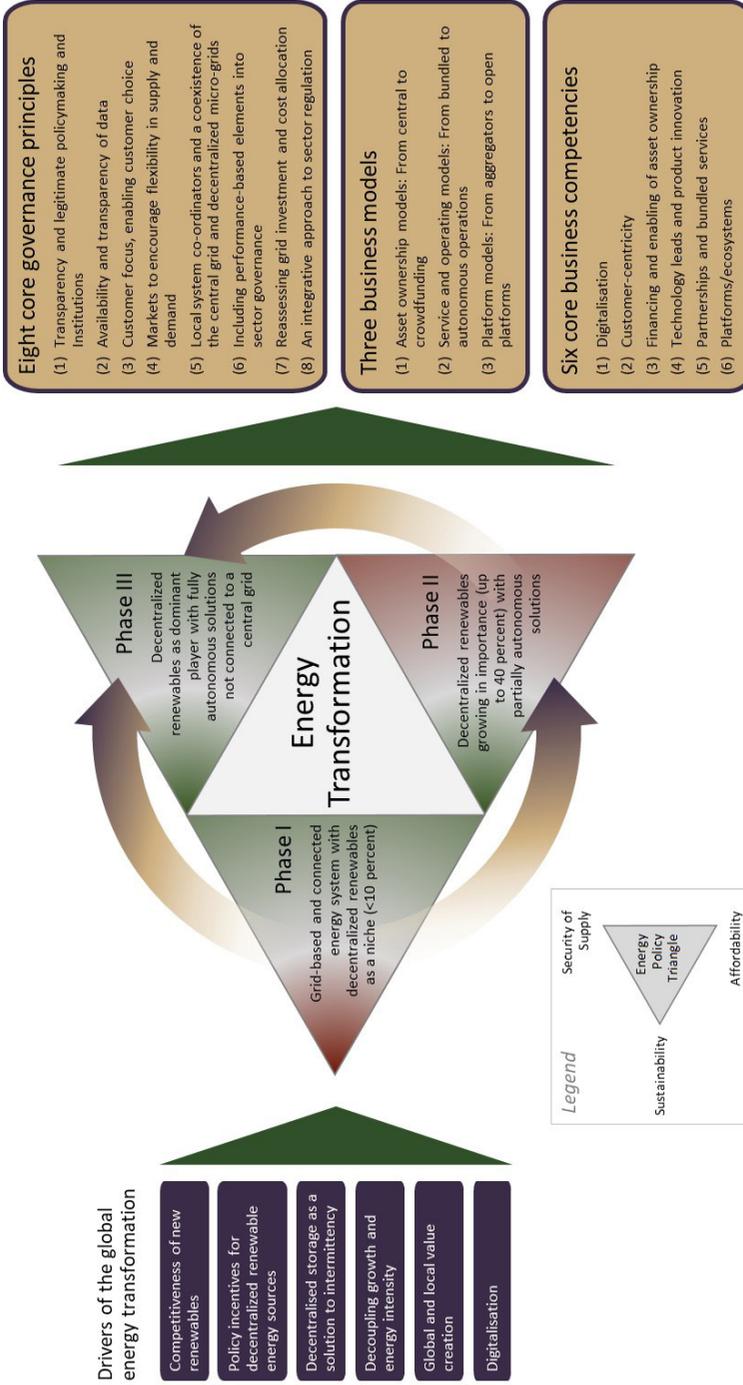


Figure 42: Governance principles and business models in the three phases of the energy transformation.

Source: Authors' contribution.

spearhead the financing revolution in terms of crowdfunding and initial coin offerings (ICOs).

(4) Technology leads and product innovation

Technology and product innovation will not only occur in the digital sphere, but also as tangible objects embedded in the new system – be it proprietary devices to steer micro-grids, customised sensors to enhance building efficiency, or drones to verify the functionality of rooftop solar panels in remote regions in Africa or South Asia. Technological advances and innovations give start-ups and established companies the leading edge and competitive differentiation. If businesses rely on pure digital service models, they can easily be crowded out by larger and financially stronger rivals.

(5) Partnerships and bundled services

New business models will also result from new partnerships that share financings, infrastructure and asset ownership. In a complex and highly dynamic market environment, no single company is able to provide all the elements of its value proposition by itself. With the increasing convergence of the energy and transport sectors, digitalisation affecting all aspects of our lives, and multinational companies entering energy markets, executives face no other option than to enter partnerships and alliances if they want to survive in the marketplace.

(6) Platforms and ecosystems

Digitalisation allows multiple players to enter markets and match supply and demand. Ownership of physical assets may not be necessary to succeed in the marketplace. The value proposition is derived instead from the coordination of providers and seekers of certain services. Sometimes these markets do not exist and have to be established, such as the market for demand response in Europe and the USA.

Figure 42 highlights the main insights.

The global transformation of the energy sector has just started. Certain major international institutions, as well as many political and corporate decision makers across all continents, are taking key roles and responsibilities in the process. If the rise of decentralised energy not only continues at the current rate of acceleration but is able to speed up as a result of good governance, then the globe may be on track for meeting the required greenhouse gas cuts whilst also benefitting from the opportunities of innovation.

