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AT A GLANCE – ENERGY EFFICIENCY NR. 4

The vision of climate-neutrality and the role of Energy Efficiency

The central point in the energy transition is the security of supply, which is influenced in particular by the weather-dependent feed-in of renewable energies. The change from demand-driven to flexible, weather-dependent energy production requires adjustments in all areas. The implementation of energy-efficient measures, supported by digitalized applications and processes, can make an essential contribution here and improve system efficiency in the long term. The reorganisation of the systems will gain relevance in the future in order to realise the vision of a climate-neutral future.

The Europe-wide share of renewable energies in gross electricity consumption is developing positively. However, this is put into perspective by a persistently low impact on primary energy consumption. This context can be explained by the necessary reorganization of energy systems to adapt the changing framework conditions. In order to ensure the supply even in times of low renewable production, conventional thermal power plants provide continuous energy to guarantee the baseload. If renewable production increases, coal-fired power plants in particular behave very inflexibly due to high start-up and shut-down costs. This results in overproduction, which has a major impact on primary energy consumption and also causes high energy price volatility. To counteract these developments, it is very important to make demand more flexible in terms of energy efficiency. Potential for flexibilization can be found in many areas. For example, energy-intensive companies such as aluminum smelters or cement works generally have high flexible loads that can be postponed to times of high renewable production.[1] A resulting balance between electricity generation and consumption improves the integration of renewable energies and contributes to the stabilization of grids. Correspondingly intelligent control systems make it possible to establish connections between consumption optimization (energy efficiency) and improvements of the overall system (flexibilization).

Digital applications offer the possibility to recognize and use these system connections. With the help of artificial intelligence and the collection of large amounts of data, implemented energy management systems, for example, can provide important insights and optimize energy consumption in the long term. So-called smart meters – energy meters that provide consumption and the respective costs in real-time – create incentives for consumers to consume energy in cheap hours (periods of high production of renewable energy). At the same time, network operators are enabled to develop pricing models to optimize network utilization. The high speed of data evaluation – partly supported by artificial intelligence – also makes it possible to control decentralized supply via appropriately granular networks. This reduces network expansion costs and prevents transportation losses.

Consumption optimization using the example of Google:[2]

2019 was the third year in a row in which the internet company covered its energy needs completely with renewable energies. This was made possible by a carbon-intelligent computing platform, developed specifically for this purpose. With the help of this system, extensive computing power is only started if the weather conditions guarantee a correspondingly high production from renewable energy sources.

While this approach already makes it possible to shift the computing power to corresponding hours, plans for the future include distributing the computing power across regions to data centers in order to take advantage of regional weather differences and the resulting differences in the production of renewable energy.

In particular the negative correlation between wind and solar production can create advantages here.

The technical possibilities open up the prospect of using decentralized renewable power supply to increase sector coupling - including buildings and transport - and thus weaken the target order of fossil supply. In order to achieve the move away from fossil fuels, increasing electrification will be required in other areas. In the transport sector, this includes the expansion of electric mobility. In this sector, too, the price of electricity will create incentives to shift the charging process to hours of high renewable production and correspondingly lower prices. This will sustainably improve grid stability and the efficient use of renewable resources.

[1] *DENA (2020)*

[2] *https://www.blog.google/inside-google/infrastructure/data-centers-work-harder-sun-shines-wind-blows/*

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Electrification - also in connection with the building sector - correlates strongly with the respective energy prices and is therefore already much more advanced in Northern Europe. Digital applications in particular make electrification cost-effective. In addition, the resulting, flexible and price-driven demand can lead to a stabilization of capacity utilization and consequently reduces the volatility of energy prices. As a result, the earnings of producers of renewable energies are stabilized and expansion is subsequently promoted. Any remaining excess capacity can be used for indirect electrification in line with demand. This involves the conversion and thus storage of electrical energy into synthetic fuels and e.g. hydrogen. These energy carriers are available for further use and enable climate-neutral operation.

These interrelationships illustrate the key role of energy efficiency. The synergy effects of renewable energies are used and primary energy consumption and emissions are significantly reduced. Progress in digitization and electrification points the way to reforming the design of production and network capacities in a sustainable manner and adapting them to changing conditions.

Conclusion

Energy efficiency is a cornerstone of energy system transformation. In addition to the savings needed to achieve climate targets, synergy effects with renewable energies offer great potential for the decarbonization of the economy. For this reason, the speed of implementation and the visibility of energy efficiency must be accelerated and increased. Only in this way can the limitation of global warming to below 2°C be achieved. In order to achieve this goal, the IEA estimates that from 2035 onwards almost half of global energy investments will have to go into energy efficiency.

Cross-cutting technologies offer enormous savings potential across all sectors. In connection with energy efficiency measures, digital technologies open up the possibility of successfully reorganizing the energy supply. Sector coupling and the associated electrification are necessary in order to achieve a move away from fossil fuels.

Energy efficiency measures offer high potential to generate advantages from a company's point of view. By contracting, savings are possible without tying up capital, while service providers, investors and society also benefit from the measures.

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