The Challenge of Renewable Energies & Decentralized Power Systems – State of the Art, Potentials & Perspectives- Prof. Krauter, Uni Paderborn

Development of human civilization always depended on the availability of energy and resources: Energy for transportation via human or animal power, flowing rivers or winds on the seas - energy for food processing, energy for clothing fabrication, energy for heating. Decline of civilizations have often been triggered by a change of availability (often man-made) of sufficient resources to use or convert energy:
Insufficient wood for shipbuilding in case of the Greek civilization and the Roman Empire; depletion of water flows, firewood, coal, oil and gas in numerous settlements, countries and regions from ancient times until nowadays.
Therefore, sustainable use of energies is not about fashion, it is about survival. Nowadays renewable energies are the only technologies available and developed to guarantee for long-term sustainability. Remarkable success stories can be reported: In Germany a capacity of 20 GW of photovoltaic power plants has been installed, which allows for 25% of the total energy supply via solar energy during sunny days (3% throughout the year). During stormy nights almost 100% of electrical energy supply is done via wind power in some states in Germany (28 GW of wind capacity). Countries like Norway, Iceland and Brazil have an energy supply totally dominated by hydro power.
Today, we have the means and the obligation to prepare infrastructure based on renewable energies. Such an infrastructure requires substantial changes from the present structure which has been built for conventional, non-renewable power systems. Renewable Energy sources (besides geothermal) have a higher volatility, have a lower energy-intensity and are distributed. To achieve sufficient availability and safety of energy supply the intelligent combination of different renewable energies is essential. The consumer has to be integrated, in consumption, but also in generation and decentralized storage which helps to reduce the need for costly grid extension and control power.
A similar development can be found in the history of IT: Computer use started in a very centralized manner 40 years ago, then that way became inefficient during the last 20 years, and IT today is highly decentralized but interconnected.