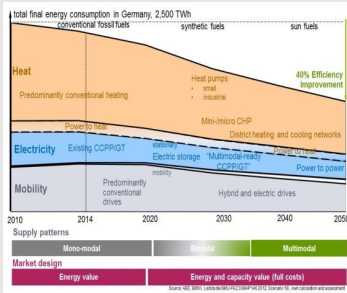


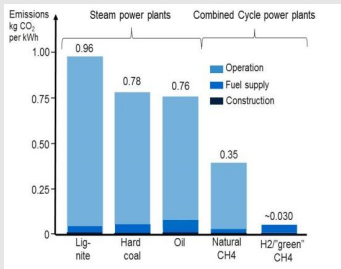
## Introduction



The fulfilment of governmental reduction targets for CO<sub>2</sub>-emissions remains the main driver for the energy system-transformation. The importance of electricity for the entire energy supply sector grows, driven by the expected future use of heat pumps, electrolysers, as well as by growing the role of electro-mobility.

The electricity sector passes a phase of political and economic challenges concerning suitable market design on the one side and necessary new investments on the other side. Besides the expansion of electricity generation capacity based on renewable energy sources, the economical operation of flexible, environmentally friendly gas-fired load control and back-up power plants becomes a condition for a further and successful system transformation.

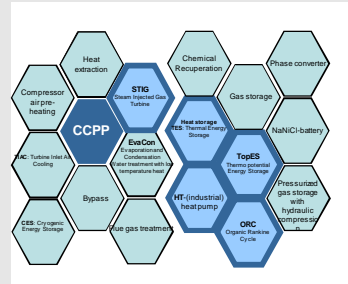
## Ecological suitability



Due to excellent flexibility characteristics, high and further increasing efficiency of the CCCP-technology CCPP and GTPP will remain also in the future the technology of choice. Opportunities for additional decrease of already relatively low CO<sub>2</sub>-emissions emerge as a result of further system transformations.

The capability of gas turbines to burn multiple gaseous fuels, starting with natural gas, then considering synthetic fuels or even projecting consumption of CO<sub>2</sub>-neutral "sun fuels", like hydrogen produced using electricity from Renewable Energy Sources (RES), or Synthetic Natural Gas (SNG) based on RES/CO<sub>2</sub> from biomass provides base for further use of gas fired generation. In a scenario with mandatory near-zero CO<sub>2</sub>-emissions from thermal generation, the technology of gas turbines with their excellent operational and unique fuel flexibility, provides further substantial arguments for the choice of this technology.

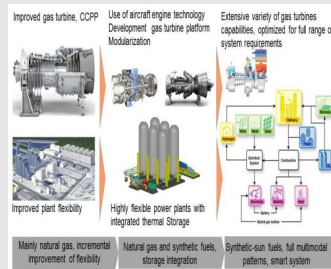
## Economical affordability



All technological and ecological advantages of gas fired power plants are however, apparently not sufficient to facilitate investment in new gas-fired capacities. Development and adoption of a suitable electricity market design will be needed to ensure economic operation of future gas turbine- and combined cycle- power plants.

The deployment of advanced, "multimodal-ready"-generation and storage technologies will provide suitable, highly flexible solutions, allowing an integration of the largest amounts of renewable generation. Simultaneously, it will offer an improvement of overall system efficiency and economics.

## Conclusion



The role of the electricity in the final consumption of energy grows. The energy supply patterns of the future are multi-modal, with a close interlink between the supply systems for electricity, gas, heat, cooling, water and fuels for mobility. The digitalization of the energy sector based on advanced information- and communication technologies will capture potentials for the improvement of efficiency and economics.

Siemens develops multiple products and solutions in response to the future market requirements, especially in connection with further improvement of the plant-flexibility, efficiency and costs. Gas turbines being optimized to serve a wide range of new system requirements in central and distributed, open and combined cycle applications will become an integrated part of the multimodal supply systems. Solutions combining gas fired power plant technologies, using low or even zero carbon fuels and adding storage technologies, as well as technologies to use low temperature heat, will be providing crucial values to the highly flexible, low emission energy supply.

# „Energiewende“ and flexible gas fired power generation

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