

# Leinwig energy portfolio

## Introduction

The community energy profile maps the locality's current energy landscape, including:

- Current and projected future energy use and supply data
- A documentation of existing energy-related activities, programs or projects, and policies
- an overview of available human and organizational resources that can help implement new initiatives

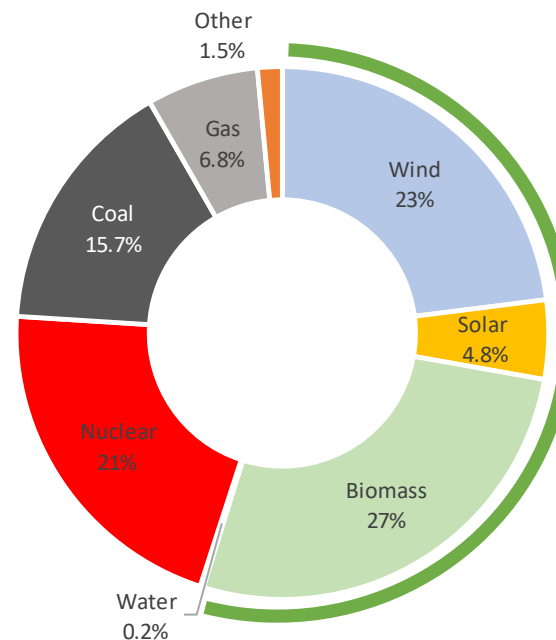
In order to achieve our community's goals as specified in the energy policy mission statement, we need to know where we are right now. The goals and strategies for a sustainable energy portfolio developed in the next steps will be effective to the degree that it is informed by current energy use and existing policy frameworks. Paying close attention to these aspects will ensure that the energy profile addresses real gaps and needs regarding our community's energy systems. Finally, the current situation serves as the baseline against which the success of future actions will be measured.

## Electric energy supply in the City of Leinwig and Leinwig County: Summary

The share of renewable energy sources among Leinwig's electricity mix is at 55%, i.e. more than half of the electric power used in Leinwig City comes from renewables and 45 percent are generated from fossil and nuclear energy sources. In Leinwig County itself, electricity is only generated from renewable sources (wind, sun, biomass, water) and electricity from regional fossil and nuclear power plants is fed into the local grid as well.

*The statistics (right) focus on the gross electricity generation and supply ('Bruttostromerzeugung/-bereitstellung') in Leinwig County. These values refer to the amount of electric power that is generated locally or fed into the local grid from regional power plants. It only refers to electric energy and does not include heat energy or fuels for transportation*

Gross electricity generation and supply in Leinwig County



Energy source	Annual electric energy production (2014)	Share of total electric energy provided (2014)
Wind	165 GWh	23%
Solar & photovoltaics	34 GWh	4.8%
Biomass & residual materials	191 GWh	27%
Water	1.4 GWh	0.2%
Nuclear	149.4 GWh	21%
Coal	111.7 GWh	15.7%
Gases	48.4 GWh	6.8%
Other	10.7 GWh	1.5%

## Wind energy

In Leinwig County, there are currently 69 wind energy plants with a total capacity of 119 MW. In 2014, 165 GWh were produced and fed into the electricity grid. This accounted for 23% of the overall electric power consumption in that year.

Leinwig County has prioritized eight areas to be used for future wind plants, which together represent 0.6% of the county's total area. Experts estimate that these zones offer enough room for the installation of new wind plants that can produce 420 to 520 GWh annually. This would cover 58 to 70% of Leinwig County's current energy consumption. There is an even greater theoretical potential of up to 1100 GWh annually for wind energy plants if the size of prioritized areas is extended and if micro-wind plants are considered, for which less restrictive legal hurdles exist.



## Biomass and residual materials

In 2015, there were 32 biogas plants, 2 sewer-gas plants and further biogas block heat and power plants in Leinwig County. In addition, two more biogas plants exist in the county that feed the produced biogas into the nationwide natural gas grid (a pipeline system for transporting gas nationally and internationally) and market it independently. In 2014, 191 GWh from biomass power plants was fed into the electricity grid, which accounted for 27% of the overall electric power consumption in that year. To feed these plants with biomass, maize crops had to be cultivated on 14% (8860 ha) of the available acreage in Leinwig County.



A study by Leinwig University estimates the future potential of energy supply through biomass at up to 200 GWh, if a mixed crop on 20 to 30% of agricultural areas can be made available to biomass energy plants. However, since the energy supply generated through so-called energy crops (i.e. plants grown as low-cost and low-maintenance harvest used to make biofuels, for example maize or millet) and farmyard manure is already at high levels today, the potential for future maximization appears limited.

## Solar energy / photovoltaics

In 2014, the capacity of all solar power plants and solar cells amounted to 39 MW; almost 34 GWh of electricity from solar cells was fed into the grid, which accounted for 4.8% of the overall electric power consumption in that year. Most of these plants are small- and medium-sized solar cells installed on top of building roofs. In addition, there are three larger-scale solar parks (free-standing solar cells) in Leinwig County. A structural development program by Leinwig city offers some financial support to solar plants, among others.



The Leinwig University study estimates that, due to the impacts of tilt angles and clouding, rooftops of public buildings owned by the city, state, or federal government offers a theoretical potential of 97,000 square meters for the installation of solar panels with a total capacity of 9 MW. If the required static tests are successful, then solar cells mounted on public buildings could supply over 8 GWh of electricity. In the commercial building sector, an area of 513,000 square meters offers a theoretical potential of 40 GWh at a nameplate capacity of 51 MW. Finally, residential buildings, with an area of 2,200,000 square meters, theoretically offer a potential of 189 GWh at a nameplate capacity of 220 MW.

## Hydro-electric power

Leinwig County is home to 6 hydro-electric power stations with a maximum effect of about 430 kW. The city of Leinwig is located inland with access to only a small river running through the city. In the reference year 2014, a total of 1.4 GWh of electric power from hydro-electric power plants was fed into the grid, which accounted for 0.2% of the overall electric power consumption in that year. Although the major river Olba crosses Leinwig County in the North-East, its waters cannot be dammed because of the river's significance for shipping traffic. Thus, experts do not believe that there is much potential for growth in this sector.



## Fossil and nuclear energy sources

45 percent of the electricity available in Leinwig County is generated from fossil and alternative energy sources and fed into the grid from regional electricity sources in Lower Saxony. These energy sources include nuclear, coal, and gas.

### Nuclear power

There were 111.7 GWh of energy from nuclear power plants available in Leinwig County's power grid in 2014, which accounted for 15.7 percent of the electric energy fed into the county's power grid in that year. There are no nuclear power plants in Leinwig County, but electricity is fed into the Lower Saxony power grid by the two nuclear power plants in Lingen/Emsland (10,955 GWh in 2014) and Emmerthal (9,481 GWh in 2014). Although the energy generated in both plants is relatively high, they are directly affected by the German federal government's 2011 landmark decision to completely phase out nuclear energy in Germany by 2022. The power plant in Lingen will be shut down by the end of 2022, the one in Emmerthal already by the end of 2021. Their input to the electric power grid will have to be replaced by other energy sources.



### Coal

As with nuclear, power from coal is not generated in Leinwig County itself, but 111.7 GWh of coal-based electric power were fed into the county's grid, accounting for 15.7 percent of the overall electricity available. Today, 13 coal power plants are operated in Lower Saxony. As nuclear power plants are being phased out, coal is emerging once again as a substitute to replace its electric energy. However, although it is cheap and reliable, it is also a fossil energy source that generates large amounts of carbon dioxide when transformed into electric energy.



### Gas

Besides coal, gas is the most important fossil energy source in the energy mix fed into Leinwig's electric grid. In 2014, 48.4 GWh generated from gas were fed into the grid, accounting for 6.8 percent of the overall energy production in Leinwig. There are currently 33 natural gas power plants operated in Lower Saxony.



## Electric power use in the City of Leinwig and Leinwig County

The supply of electric power is only one side of the equation. Creating a sustainable energy concept includes both the power fed into the grid as well as the demand and actual use of electric power, on the other hand. In the recent past, a decrease in electricity use could be identified in Leinwig because, first, the population has been stagnating in recent year, but is projected to grow in the next two decades. Secondly, the electricity demand could be reduced through technological efficiency improvements like insulation of buildings.

Leinwig County's overall electric power demand was at 759 GWh in 2009 and decreased to about 709 GWh in 2014. On average, the per capita power use decreased from 4.31 kWh in 2009 to 3,921 kWh five years later.

In 2009 (the last year for which detailed figures are available), electric energy consumption in private households reached 235,290 kWh (31% of overall use), the commercial sector used 478,170 kWh (63%), and electric power use by the public sector was at 45.540 kWh (6%).

In that same year, overall thermal energy consumption in the city of Leinwig and Leinwig County was at 3,600 GWh (these are the most recent figures available). Thermal energy consumption in private households was at 1,512 GWh (42% of overall thermal energy use), in the commercial sector as high as 1,980 GWh (55%), and in the public sector at a mere 108 GWh (3%).

### Greenhouse gas emissions

There is no reliable information available on local GHG emissions in Leinwig, which is certainly a weakness in the current state of climate change mitigation in the community. No information provided by the city of Leinwig. The climate action report by the Leinwig County Climate Protection Office only estimates carbon dioxide emissions from traffic at about 30% of the overall carbon dioxide emissions.

In Lower Saxony, the total GHG emissions were at 83 million tons carbon dioxide in 2013, the last year for which figures are available, 80 percent of these emissions were energy-induced, that means they were created in the process of burning fossil fuels to generate electricity, heat, fuel the industrial sector, and facilitate mobility. The per capita emissions were at 10.6 tons. Overall, GHG emissions are 15.2 percent lower than in 1990, but have slightly increased in the last two years.