

International Circular Economy Week

Fact sheets for technology site visits

Institute of applied Material Flow Management - IfaS

www.stoffstrom.org



Europe's First Zero Emission Campus

BIRKENFELD



A UNIQUE PLACE ON EARTH

Inaugurated in 1996, the Environmental Campus Birkenfeld [ECB] is part of the Trier University of Applied Sciences that offers interdisciplinary higher education in the fields of; a.) Environmental Planning & Technology, and b.) Environmental Business Management & Law. Home for more than 2700 students specializing in environmental education, ECB is designed as an incubator and a demonstration site for environmental technologies and innovations. ECB's eco-compatible building stock complemented by its sustainable utilities has helped achieve 'Zero Emission Campus' and 'Germany's 1th Green Campus' status.

KEY FEATURES

- ▶ 100% renewable heat supply based on waste wood, biogas, and solar thermal

- ▶ 100% renewable electricity supply based on biomass and PV [includes; 492 kWp roof- and façade mounted PV covering up to 40% of the electricity demand]

- ▶ 100% renewable cooling based on geothermal, solar adsorption and biomass

- ▶ Highest standards of energy efficiency achieved by; passive and plus-energy buildings, energy efficient in- and out-door lighting, building automation installations

- ▶ Sustainable water resource management implementations: including rainwater harvesting and reuse, rainwater infiltration, waterless urinals, etc.

MORE INFORMATION

www.umwelt-campus.de



Repurposed Landscape with Renewable Energies

MORBACH



REPURPOSE AT ITS BEST

In 1996, Morbach—formerly home for the largest ammunition depot of the US Air Force in Europe—was repurposed as an energy landscape with the intention of offsetting many GHG equivalents as possible through renewable energy implementation to create a ‘Zero Emission’ community. Since then, various renewable energy technologies including, wind, PV, biomass energy were implemented abating ca. 32,500 tons of CO_{2-e} per annum through 50 million kWh/a of electrical energy generation. Besides renewable energy generation, direct GHG emission reduction through energy efficiency improvement and integrated environmental protection technologies and strategies are also implemented at Energy Landscape Morbach.

KEY FEATURES

- ▶ Originally, there were 14 wind turbines with an installed capacity of 2 MW each. They were replaced by 7 wind turbines with a capacity of 4.2 MW each, which generate about 70 million kWh per year, twice as much as the 14 old wind turbines.
- ▶ 40,000 m² of PV modules amounting to 4.2 MWp installed capacity, produces 4 million kWh/a
- ▶ Biogas plant (500 kW_{el} & 700 kW_{th}) exclusively operated with renewable raw material supplied by 15 local farmers
- ▶ Wood pellet production plant with the capacity of 15,000 t/a using heat from biogas CHP and electricity supply from wind turbines
- ▶ A wood-chip based power plant of the installed capacity of 750 kW

MORE INFORMATION

www.energielandschaft.de



Greenery Waste Treatment and Energy Production

KIRCHBERG/SIMMERN



HEATING WITHOUT GLOBAL WARMING

Environmentally benign district heating is a priority of Rhein-Hunsrück Entsorgung [RHE] thus actively invested in biomass-based heating in the Kirchberg, Simmern, and Emmelshausen communities since 2010. Focusing strongly on the Regional Added Value of its actions, RHE utilises regionally available woody biomass residue (trees and shrubs) to produce biomass fuel (fuel processing involves: cutting, sorting, drying, shredding, etc.) that is subsequently used in biomass burners to produce climate neutral heat energy for district heating. Produced heat energy is supplied to a school building in Simmern, a swimming pool and the town hall in Kirchberg, a library in Emmelshausen, and also to a home for the elders in the neighbourhood. Added to the portfolio of green energy production RHE has also invested in a sizable PV plant through which completely fulfils its own energy requirement in administrative buildings and supply the balance to the regional grid

KEY FEATURES

- ▶ Gross thermal energy production in the two counties amount to 8.4 million kWh/a (equivalent avoidance of heating oil is 610 kL/a) through 2.25 MW capacity biomass burners
- ▶ Total GHG offset (through biomass heat use) amounts to 1,045 t CO₂-eq/a
- ▶ Maintains three district heating networks of 2.75 km length
- ▶ Installed capacity of PV plant amounts to 1.7 MWp, which produces ca. 1.36 MWh of electrical energy per annum

MORE INFORMATION

www.energielandschaft.de



Treatment facility for municipal organic waste

KIRCHBERG/SIMMERN



INNOVATION WASTE RECYCLING PROCESS

Employing modern technology in its waste management the city of Kirchberg has managed to drastically reduce the amount of recyclable waste generated and disposed of in landfills. The intelligent technology is capable of recycling the wastes produced by more than 103,000 inhabitants from 137 communities

KEY FEATURES

- ▶ 40% of residual waste is converted into a fuel substitute
- ▶ 20% of waste in the process of rotting is turned into water and CO₂
- ▶ Rest 40% is taken to the landfill and disposed of in environmentally friendly measures

WASTE FACTS

Waste type	Amount
Residual waste	10,000 tons
Biowaste	14,000 tons
Green waste	24,000 tons
Paper	9,000 tons
Light packaging	4,000 tons
Bulky waste	2,000 tons
Wood waste	3,000 tons

MORE INFORMATION

www.rh-entsorgung.de



Sustainable Utility & Infrastructure Through Synergies



TRIER

FRONTIERS IN UTILITY

Stadtwerke Trier [SWT] is a utility and infrastructure service provider that supplies electricity, gas, potable water, wastewater management, public transportation etc. to the city of Trier. What sets apart SWT from any other utility and infrastructure service provider is its unique management model, which is essentially based on cooperation between different business entities creating synergies for efficient 'Regional Material Flow Management' toward a higher degree of climate protection. To achieve triple-bottom-line sustainability and climate protection, renewable resources and sustainable technologies utilisation are systemic to SWT's work. This model could be an archetypal example of how sustainable utility and infrastructure may be implemented in conventional municipalities around the world

KEY FEATURES

- ▶ Installed wind energy capacity (three wind parks) amounts to 45.9 MW through which 79 million kWh/a could be generated offsetting 38.5 kt of CO₂-eq/a
- ▶ Installed capacity of PV plants (total of 13) amounts to ca. 44.25 MW that collectively have the capacity to produce ca. 44.4 million kWh/a offsetting ca. 57.3 kt of CO₂-eq/a
- ▶ The two hydroelectricity plants (2.4 million kWh/a installed) have the capacity to offset 1.2 kt of CO₂-eq/a
- ▶ Both direct and indirect provision of employment amounts to 1,500 in the region

MORE INFORMATION

www.swt.de



Energy and Technology Park

TRIER



SYNERGY AMONG TECHNOLOGIES

Despite its key focus in water and sewage treatment, Stadtwerke Trier [SWT] has ventured into energy sector in which energy efficiency improvement as well as renewable energy [REN] generation is done. Through the energy efficiency initiative, SWT has reduced electrical energy consumption by 20 per cent recently.

SWT also has expanded the REN-based decentralized power generation for which two combined heat and power plants [CHP], photovoltaic [PV] systems, and a hydropower plant, etc. are employed. These RENs together ensure the energy self-sufficiency of the main sewerage treatment plant since 2016.

In addition, an artificial neural network regulates the power generation and consumption in real-time at the SWT technology park, which is among the pioneers employing such technology. SWT also aims to make the complete facility and its operations energy autonomous in the long run.

KEY FEATURES

- ▶ SWT' technology park has been recognised and certified as a 'Sustainable Business Park' and its buildings are DGNB certified
- ▶ SWT' ETP creates synergies by offering office space for 400 employees of municipal authorities and other institutions
- ▶ SWT' long-term target is to achieve CO₂ neutrality and energy autarky in all its operations/processes

MORE INFORMATION



www.swt.de

Energy Autarky Wastewater Treatment



TRIER

AN UNCOMMON SOURCE OF ENERGY

Energy consumption of wastewater treatment being one of the largest cost components, Stadtwerke Trier [SWT] took a major step forward in 2013 to improve the energy and resource efficiency of its WWTP not only to reduce the costs but also to improve the environmental compatibility of its operations. Key drivers for resource efficiency at SWT WWTP include process optimisation, energy-efficient technologies, onsite renewable energy generation, and integrated intelligent process management technology.

A key highlight of this plant is the production of renewable energy i.) via the utilization of organic matter of sewage sludge in an anaerobic digester (ca. 2.7 million kWh/a), ii.) through a roof-mounted PV plant (ca. 70,000 kWh/a), and iii.) through flow-turbines and energy recovery etc. (ca. 0.51 million kWh/a) making the complete wastewater treatment process an energy autarky system. As can be seen, the bulk of the energy is produced through biogas.

KEY FEATURES

- ▶ SWT WWTP annually repurposes eight million m³ of wastewater. It saves ca. one million kWh of energy through energy efficiency measures and produces ca. 3.3 million kWh of renewable energy each year
- ▶ The GHG abatement of the plant amounts to 2 kt CO₂-eq/a
- ▶ Energy surplus of the plant as of 2016 amounts to 0.2 million kWh/a

MORE INFORMATION

www.swt.de



Drinking Water Treatment Plant

TRIER-IRSCH



A UNIQUE ENERGY-EFFICIENT SOURCE OF CLEAN WATER

In line with its commitment to energy efficiency and environmental responsibility, Stadtwerke Trier (SWT) has taken remarkable steps to enhance the sustainability of its Irsch Drinking Water Treatment Plant. Recognizing the significance of energy consumption in water treatment, SWT has not only reduced costs but also significantly improved the environmental compatibility of its operations. SWT's focus on resource efficiency at the Irsch Drinking Water Treatment Plant centers on process optimization, energy-efficient technologies, onsite renewable energy, and integrated process management technology.

The Irsch Drinking Water Treatment Plant was constructed in 1958 and boasts two turbines. These turbines take advantage of a fall height of approximately 90 meters and have an installed power capacity of 320 kW. Impressively, the plant produces an annual energy output of 1,000,000 kWh, which is equivalent to powering 286 households, each consuming an average of 3,500 kWh per year.

KEY FEATURES

- ▶ Source: 4.5 million cubic meters Riveristalsperre reservoir
- ▶ Total capacity: 600 kW, producing 1.5 million kWh yearly
- ▶ Green energy production reduces carbon footprint by 310 tons CO₂ equivalent annually

MORE INFORMATION

www.swt.de



Centralized Waste Management System

KAISERSLAUTERN



TRAILBLAZING IN WASTE MANAGEMENT

The Central Waste Management Kaiserslautern [CWMK] serves the administrative territory of Kaiserslautern with 250,000 inhabitants. The solid waste management is entirely handled by CWMK, an ISO 9001 & 14001 certified company, in which, Mechanical-Biological Treatment [MBT] of waste and the co-generation of heat and electricity [CHP] of biomass is done on-site at an 88 ha facility. The centralization of the waste management to handle large volumes of biomass waste efficiently and effectively with state-of-the-art technologies achieving substantial economic, environmental and social benefits is clearly demonstrated at CWMK.

KEY FEATURES

- ▶ The annual utilization of biomass including matured timber, fresh timber, and green waste amounts to 25,000 tons
- ▶ Installed capacity of thermal energy amounts to 13.3 MW
- ▶ Electrical energy generation capacity amounts to 3.3. MW
- ▶ Generates ca. 18 million kWh of electricity which ensures energy self-sufficiency and feeds 12 GWh to the grid
- ▶ Generates 42 million kWh of heat, which is fed to the grid and sold to the municipal utility of Kaiserslautern

MORE INFORMATION

