HOLINGER
the art of engineering

SUSTAINABILITY REPORT

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SUSTAINABILITY AT HOLINGER

As a service company, developing solutions for our clients is our daily business. Most of the time, these solutions involve public infrastructure that needs to last for a very long time. We are not satisfied with our own work, until we have taken all the various stakeholder groups' needs into account and adequately considered the manifold aspects of the project. This is the only way to ensure that a project can be approved, and that the completed construction can fulfil its task in the long term. Our greatest contribution to sustainable development is, therefore, to carefully and prudently plan on behalf of our clients. However, we also record our own ecological footprint and critically assess our own impact. This sustainability report is a presentation of the data that we use for this purpose.

ABOUT THIS REPORT

In this sustainability report which covers 2020/2021, we discuss the sustainability of our own company taking the relevant economic, environmental and social factors into account. We also show how we promote sustainable development by presenting our featured 'lighthouse projects' and other examples of our activities. These projects are outstanding in terms of their beneficial environmental impact on plant or animal life, aquatic habitats, the air we breathe or the water we drink.

SUSTAINABILITY STRATEGY

At HOLINGER, we assume social and environmental responsibility, both within the company and within the scope of the projects that our clients commission. In 2020, the Board of Directors set the target of achieving net zero carbon emissions by 2030. To implement this, we set up the Sustainability working group, which sets goals and develops measures to constantly improve HOLINGER's performance in this regard. The working group has developed a roadmap that is now being gradually refined and implemented. In the coming years, our focus will be on those areas where we have the greatest influence – the energy requirements for our offices, our mobility and our IT infrastructure. At the project level, we are training our employees to conduct sustainability assessments; however, we need to look into social sustainability more closely.

SUSTAINABLE DEVELOPMENT THANKS TO OUR PROJECTS

In our daily project work, we are reducing environmental pollution and working to save natural resources, or at least use them more wisely. At the same time, we aim to deliver solutions that are long-lasting and economically viable. As we design and construct efficient, state-of-the-art environmental infrastructure and develop concepts and maintenance solutions, we focus on long-term considerations and take the entire life cycle of the project into account when planning.

OUR OWN FOOTPRINT

This sustainability report is a record of HOLINGER's resource consumption (electricity, fuels, paper, etc.) and presents a calculation of our greenhouse gas emissions. These measurements allow us to identify areas for improvement. As with wider society, the primary areas that we need to address are mobility, the building sector and power consumption.

OUR PERFORMANCE AS EMPLOYERS

Our prioritisation of the solid economic development of our company translates into taking full responsibility for our employees by continuing to invest in high-quality workplaces and offer above-average social benefits. We are particularly proud that HOLINGER employees can participate in the company as shareholders. Conducting regular employee surveys allows us to measure satisfaction, so that we can work on the areas with potential for improvement.

ECOENTREPRISE CERTIFICATION

We currently hold the ISO 9001:2015 certificate for quality management. In 2020, we also received the "EcoEntreprise Excellence" ISO 26000-based certificate for sustainable and socially responsible corporate management.

OUR BUSINESS AREAS

WATER SUPPLY

We ensure that the population has access to drinking water in sufficient quality and quantity.

URBAN DRAINAGE

We are committed to ensuring that wastewater is properly discharged and treated to protect water resources.

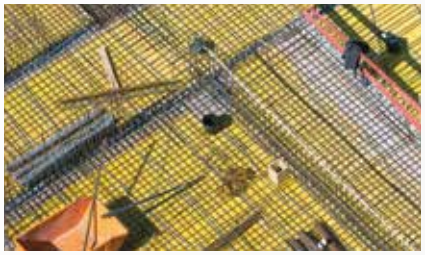
WASTEWATER

We offer future-oriented solutions for conversions, extensions, renovations or new construction of wastewater treatment plants.

HYDRAULIC ENGINEERING

With an interdisciplinary approach, we create attractive aquatic landscapes that enable a variety of uses.

CONSTRUCTION



As a reliable partner in all phases of project planning and construction management, we ensure the durability of structures.

ENVIRONMENT

We find optimal solutions that balance the tension between economic interests, regulatory considerations and environmental factors.

GEOLOGY

We are specialists for questions about groundwater, geothermal energy, site subsoil, contaminated sites and natural hazards.

ENERGY

We develop and connect renewable and non-renewable energy sources and exploit savings potential.

INDUSTRY

We develop economically and environmentally optimed solutions while prioritising smooth operations.

HOLINGER AT A GLANCE

41
is the average age of our employees

20
HOLINGER locations in Switzerland

60 %
of pension fund contributions are paid by HOLINGER as an employer

1,7 t
CO_2 emissions per full-time position (t CO_2-eq per FTE)

2 084
projects worked on in 2021

22
professions at HOLINGER giving their best every day

37 %
of our employees work part-time

12
countries are on our world map of projects

596
qualified and motivated employees work at HOLINGER

73
CHF million in sales, 16 % more than in the previous year

25 %
of the heat we use comes from renewable energy sources

91 %
of our electricity is eco-electricity

11 %
of own electricity requirements are covered by our solar power system in Liestal

10 000
kWh primary energy requirement (oil-eq) per full-time job

8,4
CHF million cash flow

147
employees are shareholders and hold 100 % of HOLINGER shares

34 %
of employees are women

42
training hours per employee each year

42 times
around the world for our customers per year

11
HOLINGER locations abroad

ENVIRONMENT AND RESOURCES

This sustainability report covers the entire HOLINGER Group. Whenever energy consumption was only recorded for part of the Group, figures were extrapolated to match the number of full-time positions. The scope of analysis is comprehensive and also includes the employees' commute to work. We based our primary energy consumption (kWh oil-eq) and greenhouse gas emissions (CO_2-eq) calculations on the Federal Coordination Unit for Construction and Property (KBOB) life cycle assessment data from 2022. For mobility, heat and power consumption, we took the entire life cycle into account, but for buildings, we included only the operational energy requirements. The grey energy of the buildings was not included.
In order to assess the trend, when interpreting the data, we considered the change in the absolute and relative numbers in relation to full-time positions. Full-time positions increased by 19 % from 2019 to 2021. Because of the home office mandates arising from the Covid-19 pandemic, the extent to which we can draw comparisons with the 2019 data is limited. In other words, the figures for 2021 cannot necessarily be interpreted as a long-term trend.

ELECTRICITY

HOLINGER's power consumption for servers, IT, light, ventilation, hot water etc. was 455,000 kWh in 2021. Relative power consumption per FTE increased by 5 % compared to 2019. The increase is primarily due to the new office locations that were included in 2021.
With our electricity being derived from a mix of approximately 80 % hydropower, 11 % renewable energies and 9 % non-renewable energies (including nuclear energy), this corresponds to a primary energy requirement of around 650,000 kWh (+40 %) and greenhouse gas emissions of 8 t CO_2-eq (-60 %) per year. The primary explanation for the decrease in CO_2 emissions is the calculation method.
Note that the additional electricity consumed by our employees when they work from home instead of in our offices is not taken into account. In 2021, 66 FTEs worked at home an average of 20 % of the time (= 50 days per year). This roughly corresponds to an additional power requirement of 2,000 kWh per year, which is less than 1 % of the total power consumption. The power consumption of electric company cars is accounted for in the business mobility figures rather than under electric power consumption.

PAPER CONSUMPTION

HOLINGER consumed approximately eight tonnes of paper in 2021 for reports, documentation and plans. This is roughly the same as in the base year, 2019. There has been a slight decline per full-time position. The paper we use is 50 % recycled, and our greenhouse gas emissions from paper consumption amounted to around 10 t CO_2-eq

HEATING/HEAT

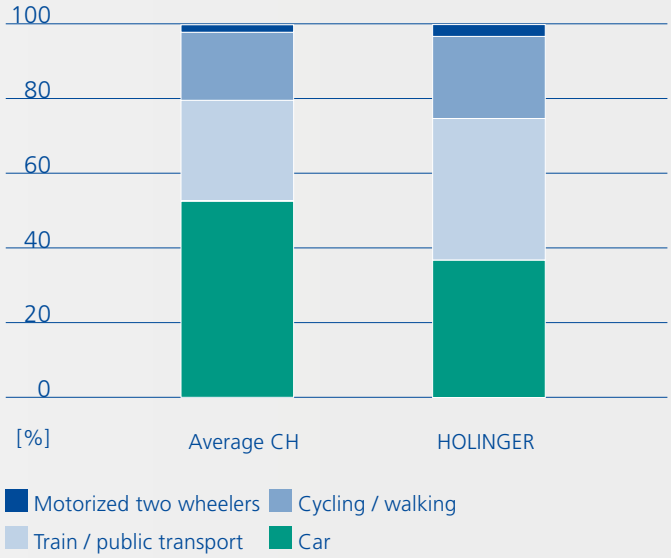
We obtained 58 % of our heat from gas, 17 % from oil, 20 % from the district heating network and 5 % from heat pumps. Our heat requirement was 1.1 million kWh, or 1.2 million kWh oil-eq, and caused greenhouse gas emissions of approximately 230 t CO_2-eq. With 90 kWh per m^2 of effective floor area, consumption is in line with the Swiss national average.

BUSINESS MOBILITY

In 2021, our employees travelled a total distance of 1,700,000 km for work-related trips such as meetings, projects and professional development. The total distance has increased by approximately 6 % compared to 2019, but this corresponds to a decrease of around 11 % per full-time position.
The primary energy consumption was 1.45 million kWh oil-eq, and our greenhouse gas emissions were 311 t CO_2-eq. The primary energy requirement and greenhouse gas emissions per full-time equivalent have increased by around 30 %. This increase is partly due to the fact that KBOB increased the emission factors used in our calculations by +12 %. The distances covered on trips abroad amounted to 88,000 km. The primary energy requirement was approximately 47,000 kWh oil-eq, and the greenhouse gas emissions around 25 t CO_2-eq.

COMMUTING

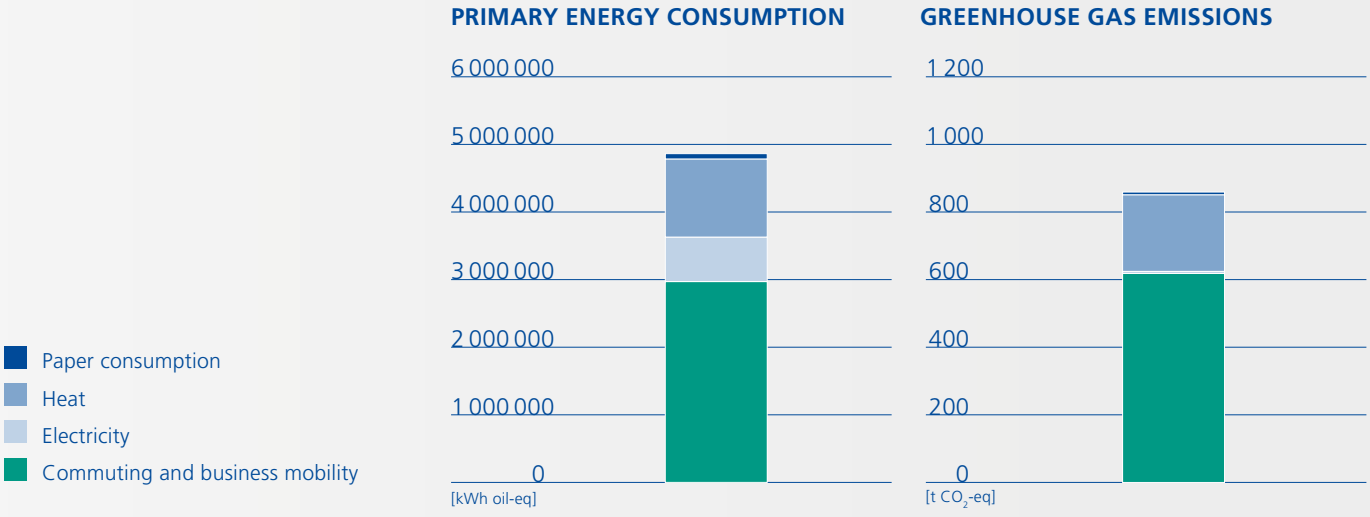
The impact of commuting was evaluated on the basis of 10 branches. Commuting distances ranged from 0.4 to 115 km with an average distance of around 20 km and an average time of 30 minutes. This places us in the range of the Swiss average, which was 13.6 km and 30 minutes in 2020.
In Switzerland, 50 % of Swiss commuters use cars, and 27 % use public transport as their primary means of transport. At HOLINGER, the proportion of those commuting by car is much lower. Public transport and bicycles make up a large proportion of commuter mobility. The distance of the commute is also decisive for the environmental impact. A total of 2.78 million km were covered in 2021, almost 45 % of which were by car. Extrapolated to the entire company, employees circled the earth 68 times on their way to work in 2021. In so doing, they consumed around 1.49 million kWh of primary energy associated with CO_2 emissions of around 290 t CO_2-eq.
In order to compare commuting mobility in 2019 and 2021, the statistics were converted to the same number of working weeks, and the obligation to work from home due to the pandemic was factored out. The numbers show that commuting mobility has increased less than company growth. In absolute terms, there has been an increase in commuting (+11 %), but there has been a 7 % decrease in kilometres travelled per full-time equivalent. This is primarily due to the new possibility of regular home office work.



TOTAL ENERGY CONSUMPTION AND GREENHOUSE GAS EMISSIONS

HOLINGER consumed a total of approximately 4.9 million kWh of primary energy in 2021. The associated emission of greenhouse gases was 850 t CO_2-eq. For each full-time equivalent, this results in primary energy consumption of around 100 kWh of oil-eq and greenhouse gas emissions of 1.7 t of CO_2-eq.
Im Vergleich zu 2019 ergeben sich folgende Veränderungen:
- Absolute primary energy consumption remained unchanged, and greenhouse gas emissions decreased by 5 %.
- The relative consumption of primary energy per full-time equivalent fell by 15 % and that of greenhouse gas emissions by 20 %.

The reduction in energy consumption is largely due to the reduction in use of the company premises as a result of the pandemic-related home office mandate and the more precise collection of data on the consumption of energy for heating the offices.

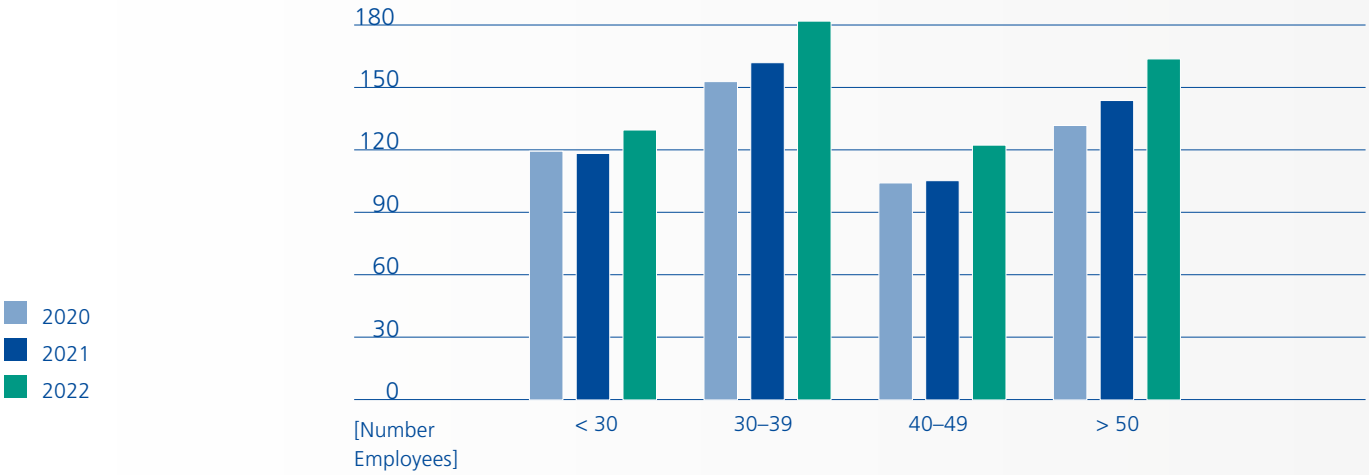


CARING FOR HUMAN RESOURCES

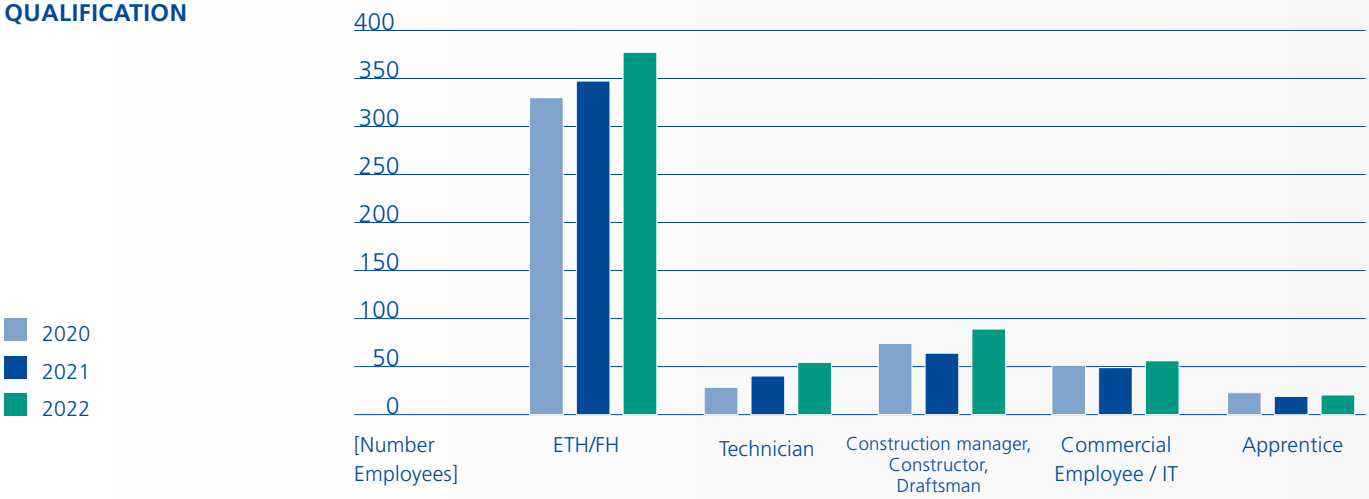
TREND AND COMPOSITION

HOLINGER has grown steadily since its foundation in 1933 and has created many new jobs for qualified employees. This growth continued in 2021; compared to the previous year, the number of employees in the HOLINGER Group has increased by 13 % to 596 employees. The age distribution shows a balanced mix of young talents and veterans. The average age is 41 years. We employ top level specialists – 63 % of employees hold a degree from a university or technical college.

AGE DISTRIBUTION



QUALIFICATION



EQUAL OPPORTUNITY

At HOLINGER, our policy is equal pay for work of equal value. Thus, we involve an external body to verify and certify that we do indeed pay men and women equally. Our employees come from 30 nations and represent 22 professions. The proportion of women in engineering occupations is low compared to other occupations – in 2015, around 16 % of all engineers were women; at HOLINGER, it will be 34 % in 2021. This means that HOLINGER employs significantly more female staff than other engineering offices.

INITIAL AND CONTINUING EDUCATION

HOLINGER trains qualified professionals. 18 apprentices are with us training to become a federally-certified draftsman specializing in civil engineering. The number of apprentices has ranged from 18 to 23 over the past five years. The training of our employees is central to our success. With around 20,000 hours of training (2019), our employees have developed and strengthened their knowledge and skills. This corresponds to an average of 42 hours per person. In addition to technical expertise, we value personality training and social skills.

ENTREPRENEURIAL PARTICIPATION

HOLINGER is 100 % owned by its employees, so we are independent of any third-party interests. At the same time, employees can have a say as shareholders and profit from the company's success. After two years of service, each employee is entitled to purchase shares. The group of shareholders grew by 16 % in 2021 and currently comprises 147 employees

ATTRACTIVE CONDITIONS

Around 37 % of our employees work part-time. They do this primarily for personal reasons, for example because they are looking after children or relatives. HOLINGER covers 100 % of the expenses for non-occupational accident insurance and daily sickness benefit insurance for its employees. We also contribute 60 % of our employees' Pension Fund payments, which is over the legal minimum.

HEALTH PROMOTION AND ACCIDENT PREVENTION

In order to protect employees at work, the management of HOLINGER has signed the SUVA safety charter. HOLINGER thus undertakes to comply with and enforce the regulations in projects when we are responsible for planning and construction management. We also run various prevention courses, such as the "Safe Apprenticeship" adventure parcours and the "Footbag" balance programme, in cooperation with SUVA. In 2021, employees took part in the "Bike to Work" initiative for the second time and cycled to work for two months.

SUSTAINABLE PROJECTS
WIDE SELECTION

Around 600 HOLINGER employees in Switzerland, Germany and Luxembourg worked on approximately 2,100 projects in 12 countries during 2021. The examples presented here showcase the diversity of our projects and the contribution they make to sustainable development. In addition to the many shades of sustainability in our projects – from ecological issues such as the conservation of nature and water to energy efficiency and climate protection, there are also economic and social aspects.

FROM POWER CONSUMPTION TO POWER PRODUCTION

Until 2019, the Wollerau Corporation collected 480,000 m^3 of groundwater per year, close to the shore of Lake Zurich and pumped it to supply areas higher up. This resulted in an annual consumption of approximately 750,000 kWh of energy. In 2019, HOLINGER built a new treatment plant in the uppermost part of the supply area, and by 2021, we had implemented two drinking water power plants in two reservoirs situated at a lower elevation. Thanks to these new facilities, the corporation's energy needs have dropped to approximately 250,000 kWh per year; at the same time, it produces around 350,000 kWh of renewable energy annually.

NEW DRINKING WATER STATION IN MENDRISIOTTO

HOLINGER is planning a new water treatment plant for Lake Lugano in the "Ai Ronchi" area near Riva San Vitale. When completed, the new lake water treatment plant will compensate for the region's water shortages during droughts and provide a local alternative source. With a UF filtration system, ozonation, active carbon filtration and UV disinfection, the station will be able to supply 18,200 m^3 of drinking water per day. The best treatment chain is being chosen with the help of a special pilot plant.

WIN-WIN FOR THE PROTECTION OF WATER AND THE CLIMATE

The new regional sewage treatment plant in Payerne (VD) will be built using an A/I (Alternating Intermittent) process. This innovative process facilitates optimal operation of the activated sludge tank at all times, depending on the temperature of the wastewater and the inflow loads. This process will significantly increase nitrogen elimination while saving energy, as the aeration phases are kept as short as necessary. On top of this, the new plant will also eliminate micropollutants.

INTERFACE BETWEEN WATER ECOLOGY AND URBAN DRAINAGE

A significant number of water conservation measures are aimed at improving ecological water quality. Within the framework of monitoring, effectiveness checks and GDP processing (sub-project water bodies), HOLINGER AG assessed the influence of urban drainage on the respective body of water, determined the need for action and prioritised measures. The immission-oriented assessment is based on the external aspect and largely on bioindicators (community of aquatic invertebrates and plant growth).

RECYCLING WATER FOR CITY CLEANING

The City of Luxembourg is building a new facility to expand their operations and maintenance services. HOLINGER was commissioned to plan the facility for housing vehicles in combination with a plant for processing the substrate used for cleaning sewers. The treatment process uses only rainwater and bank filtrate from the Alzette River. To reduce the water requirement, the water is treated and filtered in a closed circuit. A PV system with a nominal output of 104 kWp (kilowatt peak) mounted on the roof of the facility also supplies renewable electricity.

EXCESS BIOGAS THANKS TO HEAT RECOVERY

The expansion of the sewage treatment plant in Collombey-Muraz (VS) will significantly improve wastewater treatment. In addition, direct discharge into the Rhone will greatly reduce the negative impact on the Bras Neuf inland canal. The heat required to heat the digestion tower and the buildings will be obtained from the treated wastewater using a heat pump, and the biogas can now be processed using membrane technology and fed into the natural gas grid.

WATER SUPPLY RENEWAL IN TAJIKISTAN

HOLINGER IC was responsible for the planning, execution, procurement and construction supervision for the renewal of the water supply network (~ 60 km of underground pipes) and the reduction of water losses (installation of 2,100 water meters) in the district of Shakhriston in Tajikistan. The aim was to improve the water supply for around 10,000 people by building new wells, river catchments and reservoirs. This project caters to the need to protect freshwater resources against the backdrop of climate change and water scarcity.

URBAN WATER MANAGEMENT

As part of the development of the Malley-Gare and Malley-Gazomètre neighbourhoods, HOLINGER AG was commissioned to study and report on the water management in these localities. Our detailed analysis took into account existing facilities, various contaminated sites, and other types of soil pollution. Based on that, we made proposals for a drainage concept. The multi-criteria analysis also called for an assessment of the impact on the environment in general and the recovery of heat from the wastewater. The solution that emerged was a wastewater retention basin (with integrated heat recovery), which reduces the discharge of wastewater into Lake Geneva during rainy weather.

BIOGAS PROCESSING SCHÖNAU WWTP

In 2021, the Combined Heating and Power plants (CHPs) of the Schönau WWTP reached the technical limit of their service life. In addition, they are no longer compliant with the Clean Air Ordinance. As an alternative, HOLINGER AG planned a new processing plant to purify biogas, so that it can be fed into the natural gas grid. We are constructing the plant during 2022. The Schönau WWTP will then have to source all of its electrical energy externally. Conversely, energy in the form of biomethane will be fed into the public gas network resulting in a net energy surplus of around 8 GWh per year for the Schönau WWTP.

SUSTAINABLE PROJECTS
INTELLIGENT WASTEWATER SYSTEMS

Traditionally, drains and sewer systems have been managed with fixed settings for each control structure. However, installing intelligent controls across the entire network makes it possible to quickly and cost-effectively avoid overloads which lead to pollution discharges. This allows us to better protect streams, rivers and lakes. The control is based on sophisticated models developed by our water protection experts. In some cases, this approach eliminates the need for additional large retention structures entirely, resulting in a significant resource savings.

WHAT ARE INTELLIGENT DRAIN AND SEWER SYSTEMS?

Even today, when it rains heavily, diluted but untreated sewage can enter our waterways. This is because, in many places, rainwater is also fed into the sewage network, which can be overloaded when it rains heavily. Large flood retention basins or stormwater overflow basins can help to attenuate the problem; however, these structures usually have static settings and are unable to take the situation across the entire catchment area into account.

However, if the overall interaction in the network is analysed and modelled, it is possible to design an intelligent control system for all the drains and control structures which can then be used to minimise the discharge of untreated wastewater and contamination of water bodies.

PROCEDURE

Dynamic wastewater modelling is based on standard surveys and models that are created for the statutory general drainage plan (GDP). Our experts determine the weak points and the areas with potential for optimisation. They run through various virtual scenarios and find the best way to regulate the structures in the network and discover how they should interact in response to different amounts of rainfall. This is then implemented in the process control system.

EXAMPLE PROJECT MEILEN (ZH)

The potential for dynamic wastewater management was evident due to the uncoordinated emptying of the stormwater overflow basins in the network and the inappropriate, uneven filling of the existing storage volumes. This led to excessive reliance on the WWTP's storage capacity.

In order to offer the best possible protection of small, sensitive bodies of water, the utilisation of the existing structures in the sewage system and at the WWTP had to be optimised. Doing this involves relatively little effort, yet it can deliver large benefits. Now, having found the right settings and specifications using a calibrated computer model of the entire drainage system we have been automatically controlling both the filling and emptying of the existing retention basins since 2019. All the structures switch individually and automatically between dry weather, rainy weather and emptying modes. This has allowed us to reduce ammonium discharges, which amounted to about one third of the total discharge of the WWTP. As a result, the pollution of streams with diluted sewage has decreased significantly. A comprehensive performance review based on the plentiful measurement data is planned for 2022.

MEILEN WWTP CATCHMENT AREA AFTER OPTIMISATION OF SEWER NETWORK MANAGEMENT

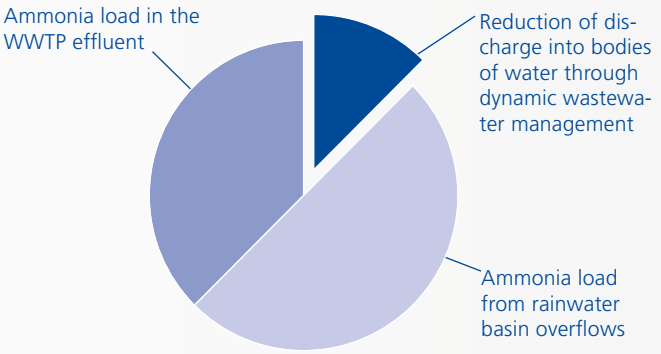


Figure: Reducing ammonium discharge into water bodies

SAMPLE PROJECT HOCHDORF (LU)

The modernisation of the Hochdorf WWTP raised treatment capacity to current state-of-the art standards and optimised its cleaning performance. However, this has resulted in a reduction in the maximum amount of wastewater that can be handled. Preliminary studies based on to conventional, static management showed that additional rainwater tanks with a capacity of up to 3,000 m^3 should be installed. This corresponds to one 50-metre Olympic-size swimming pool. The task was now to use simulations and a holistic approach to find the 'hidden' reserves in the network and to optimise the overall system, to take full advantage of all available retention volumes, and to also minimise the discharge of wastewater into streams, lakes and rivers. In the end, it turned out that, with flanking measures, no additional rainwater basins will be necessary. This will save the municipality approximately CHF 6 million.

The savings are not limited to costs but extend significantly to resources as well. For example, the construction of these rainwater basins would have required approximately 1,000 m^3 of concrete and 2,400 truck trips, which corresponds to 300 t of CO_2 emissions. This is the equivalent of the emissions from a passenger car circling the earth 40 times.

WATER PROTECTION
Even small bodies of water serve as habitats for numerous species. However, it is precisely these bodies of water that are very sensitive to large amounts of pollutants.

SUSTAINABLE PROJECTS
REVITALIZATION THROUGH NATURAL DYNAMICS ON THE WUTACH (SH)

Watercourses can be revitalised using simple structures. The most important worker is the river itself. With measures to promote natural dynamic development, rivers and streams can be ecologically upgraded, and floodplain structures can be recreated. Rare species that specialise in dynamic habitats are able to find a home again, biological diversity is promoted, and structural interventions are implemented with restraint, while initial plantings offer a sustainable approach to introducing natural dynamics.

NATURAL RIVERS

Natural watercourses such as the Wutach have formed over thousands of years and are constantly evolving. The forces of the flowing water cause erosion and bed load rearrangements, so rivers meander through valleys creating gravel banks and branched channels. This dynamic is the basis of life for niche-adapted plants and animals. Natural rivers create unique landscapes and natural biotopes for rare and endangered species. Around two thirds of all plant and animal species in Switzerland live in floodplain landscapes, which are actually biodiversity hotspots

WATERCOURSE RENATURATION USING NATURAL DYNAMICS

Natural dynamics or natural hydro forces have been used for various purposes for thousands of years. In the 18th and 19th centuries, channels were deepened and straightened with the help of river groynes. Continuous deep erosion caused the rivers to lose their lateral dynamics, destroying the niche habitats of many specialised aquatic species. By breaking down the structures of the past and giving the body of water space and points of attack, the straightening can be reversed — with the help of the river's own power.

EFFICIENT REVITALIZATIONS

Over the targeted stretch of some 300 m, the lateral bank block structures on the Wutach in Hallau were demolished, and openings were created in the dams to reactivate the floodplains. To help the Wutach start developing its own new course, material at the upriver project perimeter was excavated and relocated from the left side of the bank to the right bank, and a gravel bank was created at the same time. Small local structures were deliberately created to promote the settlement of certain target species such as the brown trout, the tree frog and the dragonfly. For example, a floodplain pond was created as a habitat for amphibians.

UPGRADING AGRICULTURAL LAND

The revitalisation of watercourses is often accompanied by the loss or devaluation of cultivated land. Along the Wutach, the material from the revitalisation and dismantling of the dams was used to upgrade the adjacent cultivated land. By looking ahead, we were able to plan the project to maximise its benefits, and thanks to these measures, the agricultural land is now better protected from flooding.

NATURE DOES THE WORK

The final intervention, planting some typical species of softwoods, followed in the spring after the construction work was completed. Now, the power of the water in the Wutach is taking over the revitalisation work. As in former times, the river is finding its own course, eroding the banks, shifting bedload and forming its own floodplain landscape. This project built on what we learnt from the last revitalisation of the Wutach—a cross-border, 1,700 m section between Schleitheim (CH) and Stühlingen (D). That river landscape has since been converted into a floodplain area of national importance. The overwhelming success of this watercourse upgrading project strengthened the decision to take additional measures.

REVITALISATION OF THE WUTACH
The final intervention, planting some typical species of softwoods, followed in the spring, after the construction work was completed. Now, the power of the water in the Wutach is taking over the revitalisation work.

SUSTAINABLE PROJECTS
NITROUS GAS MEASUREMENTS AT SEWAGE TREATMENT PLANTS

HOLINGER has a measuring device with which the nitrous oxide emissions of a WWTP can be recorded. At the same time, direct information on how efficiently the ventilation is being used is available for the first time. This can be used to develop a new type of control that minimises nitrous oxide emissions and reduces energy consumption. This type of project is now underway at the Langmatt WWTP

SEWAGE PLANTS AND LAUGHING GAS

Energy efficiency has long been an important issue for the operators of sewage treatment plants. In recent years, climate protection has also increasingly come into focus. For a long time, it was not clear whether the quantities of nitrous oxide, that are produced during the cleaning process are significant. Nitrous oxide is formed as a by-product, being an intermediate product of nitrification and denitrification. Operating conditions, such as insufficient ventilation in the critical zones of the biological tanks, can have a negative impact on the nitrification processes and thus the nitrous oxide emissions.

CLIMATE RELEVANCE OF WWTP LAUGHING GAS

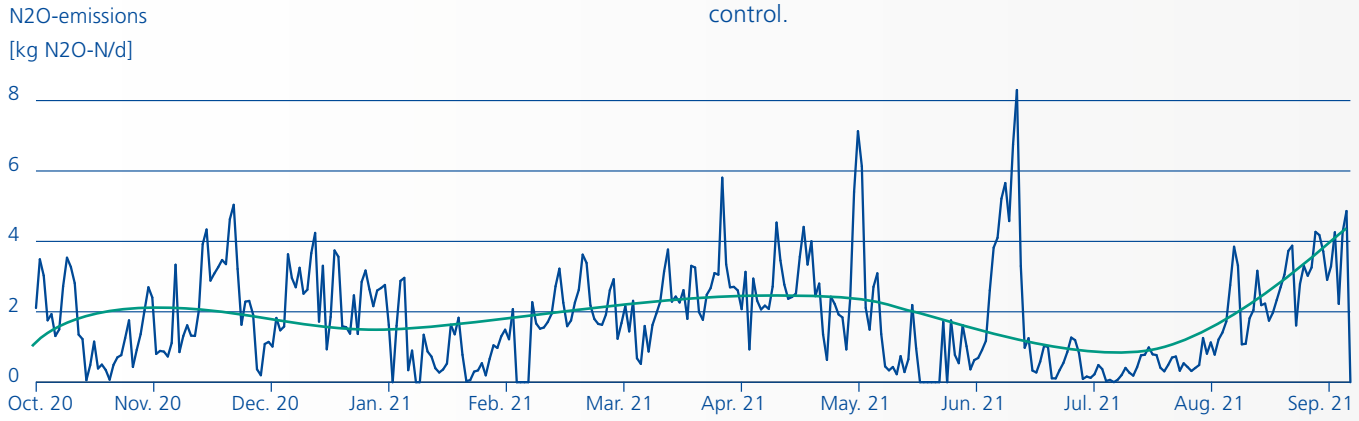
Nitrous oxide is a greenhouse gas with 300 times the greenhouse gas potential of carbon dioxide (CO_2). At WWTPs, if the emission factor (proportion of nitrous oxide emissions to inflow nitrogen load) is more than around 1 to 3 %, then nitrous oxide can exceed all other greenhouse gas emissions (methane, energy supply, etc.). The nitrous oxide emissions from sewage treatment plants can vary greatly depending on who is operating the plant, and they can fluctuate over the course of the day and the seasons. The emissions can only be determined with direct measurements. For that the exhaust air needs to be collected above the basin with collection devices and continuously analysed directly on site. Due to the high annual dynamics, a measurement campaign is needed at least once a year.

MEASURING EQUIPMENT AND NEW INSIGHTS

An exhaust air measuring device for nitrous oxide was developed and used as part of a dissertation at Eawag. HOLINGER supported this project financially and was able to take over the measuring equipment after its completion. In addition to measuring nitrous oxide, the equipment can also be used to determine the efficiency of the oxygen input and the amount of oxygen that escapes unused from the clarification tanks. This is a first for Swiss WWTPs. With this information, the aeration of the tanks can be controlled much more precisely. This could save tens of thousands of francs of electricity costs per year. The data available from the measuring equipment can now be used to control the process to minimise nitrous oxide emissions and energy consumption while maximising the cleaning performance.

PROJECT EXAMPLE LANGMATT WWTP (WILDEGG AG)

A measurement campaign, conducted in the context of a dissertation, revealed a very low nitrous oxide emission factor of 0.35 % for the Langmatt WWTP. The wastewater association is now continuing the measurements with a primary aim of ascertaining the optimal time to replace the aeration membranes in biological tanks. This can sometimes be an advantage before their lifetime is reached, because their efficiency drops, and energy consumption increases accordingly.
HOLINGER is now performing measurements on behalf of the operating association to support the ventilation membrane replacement project and collect valuable data. This means that in the future, the biological degradation of nitrous oxide emissions can be improved without compromise, and the energy consumed for ventilation can be reduced thanks to optimised control.



Evaluation of the nitrous oxide emissions from a biological treatment stage

In the evaluation example, the annual nitrous oxide emissions, converted into CO_2 equivalents, are approximately 200 t. This is equivalent to the emissions of about 50 average single-family homes heated with fossil fuels.

CONCLUSION AND OUTLOOK

PANDEMIC AND CHANGING HOW WE WORK

The pandemic has accelerated the evolution of how we work. We are working more remotely, and we are conducting more meetings online. This is reflected in the reduced mobility compared to previous years. The remaining mobility is part of our service and will not disappear in the future. That is why we are switching to renewable fuels and electromobility.

DIMENSIONS OF SUSTAINABILITY

Sustainable development can only be achieved through the simultaneous, balanced pursuit of environmental, economic and social goals. At the company level, our focus is on ensuring economic success, reducing environmental pollution and the well-being of our employees. With regard to the environment, our goal is clear. Our goals regarding economic and social sustainability have yet to be set.

Our periodic surveys show a high level of employee satisfaction. This is backed by well-developed social benefits, professional development opportunities and participation opportunities. Accordingly, staff turnover is low, which benefits the quality of our work and client relationships. We don't rest on our laurels – we are constantly evolving.

Our leverage is greatest in our own project work, where we are able to deliver major environmental benefits, be it in water protection, hydraulic engineering or in dealing with pollutants in buildings and in the ground. But even in the details of how we work, we strive to use resources optimally and to minimise our energy requirements.

«If you do what you always did, you'll get what you always got.»

Henry Ford

OUTLOOK

The pandemic rapidly changed the way we work. In the coming years, however, the change will not be as rapid. This will hopefully allow for the opportunity to implement the measures to reduce our CO_2 emissions in accordance with our roadmap. We need to improve our environmental impact data collection, so that we can also measure our efforts towards net zero CO_2 emissions.

The Sustainability working group is building up a pool of knowledge that we can sustainability put into practice in our work, life and projects.

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