

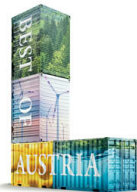
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**klimaaktiv**



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## EFFICIENT BIOMASS DISTRICT HEATING QUALITY MANAGEMENT FOR HEATING PLANTS





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## BIOMASS FOR PROFESSIONALS

Ever since the 1980s Austria has taken a leading role internationally in the construction and development of biomass heating plants and heating grids. In order to use the valuable raw material wood in the best possible way and to improve the efficiency of these plants, the quality management program klimaaktiv qm heizwerke — recommended by the European Court for Auditors — was introduced in 2006. It is a unique, worldwide, quality assurance procedure for biomass district heating plants.

Efficient biomass heating plants and heating grids do not only make an important contribution to climate protection, but also enhance investments and create green jobs. This sustainable and independent energy supply provides economic benefit which strengthens and adds value to regional development.

Showpiece installations, which fulfill top technical and economic efficiency criteria are Austria's international flagships and stimulate the export of Austrian technology and services. The initiative "Best of Austria" turns the spotlight on those who are the driving force behind this success, and provides important impulses for the culture of innovation in our country.

I am convinced that biomass district heating will make a considerable contribution to sustainable, climate-friendly and affordable energy supply in the future.



Sincerely,

A handwritten signature in green ink, appearing to read "Andr  Ruppachter". The signature is fluid and cursive, written over a light grey background.

ANDR  RUPPRECHTER  
Federal Minister for Agriculture and Forestry,  
Environment and Water Management

## THE AUSTRIAN BIOENERGY SUCCESS STORY

### HOW EVERYTHING BEGAN

Biomass in the form of wood is considered the oldest form of energy in the world. However, the use of biomass in automatic wood furnaces and heating plants has a relatively short history. The first biomass-heating plants and district heating grids in Austria were established around 1980 by the initiative of sawmill operators in order to use the by-products from their sawmills.

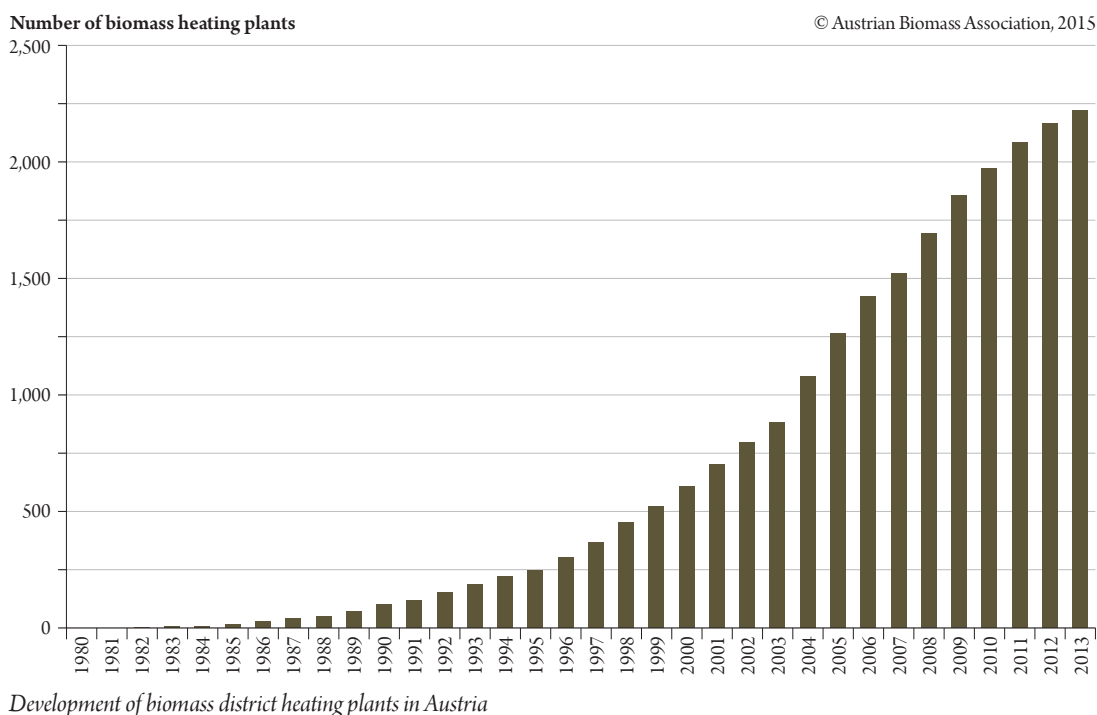
At that time the construction of a biomass heating plant was a pioneering achievement. There were no furnace or boiler technologies suitable for biomass, nor any specialist planners or information from previous experience. Correspondingly, there were very high reservations against this new technology. It took much idealism and persuasion in order to convince authorities and decision makers, especially municipalities and the inhabitants, as potential future heat customers, of the benefits and then to realize the first plants. Those plants have, since then, proven their value and were the pioneer projects for future biomass heating plants.

### A TECHNOLOGY ESTABLISHES ITSELF

The construction of new plants boomed through the initiative of agricultural and forestry holdings and cooperatives and proved the viability and functionality of this technology. Consequently, the interests of economy, science and politics significantly increased. Due to the new surge in energy- and environmental consciousness and the arising climate mitigation efforts the advantages of a biomass heating plant were quickly recognized:

- Regional
- Renewable
- CO<sub>2</sub>-neutral

The growing technological demand led to the foundation of new enterprises and a fast technological advancement of the combustion technology and systems engineering due to increased research activities and newly established research institutes. The result was among others the development of automatically fed biomass-small heating plants and its market launch.



The educational work of energy agencies and the foundation of lobbies such as the biomass association and the financial support of bio-energy projects by federal and provincial governments, enhanced the construction of further biomass heating plants and also the first biomass cogeneration plants in Austria.

**JOSEF NATSCHLÄGER**

**Heating plant operator in Ulrichsberg:**

“Biomass heating plants are an investment in our and our children’s future and a service to our society.”

**THE BIOMASS-BOOM**

Driven by the increase in oil prices and the enforcement of climate protection regulations due to the Kyoto-protocol, numerous biomass district heating plants have been built in Austria as of the turn of the millennium.

In the course of this boom, energy suppliers and enterprises that specialized in the operation of biomass district heating systems started to build and operate more and more plants.

The high demand enhanced the further development and the expansion of Austrian technology providers and led to the increasing foundation of planning offices especially for bioenergy projects and the further intensification of research activity. The adoption of a Green-Electricity-Act led to the increased construction of biomass-cogeneration plants with heat extraction to feed into district heating grids.

**THE DEVELOPMENT OF “QM HEIZWERKE”**

In 2003 on behalf of the Federal Ministry for Agriculture, Forestry, Environment and Water Management, the Austrian Energy Agency launched a study about the “Analysis of technical data of biomass heating plants in Austria”<sup>1</sup>. It said that the quality of the execution had a considerable influence on the long-term success of biomass heating plants and “... that there was considerable improvement potential in the planning of biomass heating plants.” Based on the results of this study and the vast number of new district heating plant projects, Austria launched the program klimaaktiv qm heizwerke in the frame of the climate protection initiative klimaaktiv in March 2005. The quality management system klimaaktiv qm heizwerke for biomass heating plants and district heating could be introduced nationwide in the year 2006.

<sup>1</sup> Rakos et al. (2003); Analyse der technischen Daten von Biomasseheizwerken in Österreich

**JÜRGEN GOOD**

**Engineering office Verenum,  
head of the Quality Assurance Wood Combustion:**

“Biomass heating plants with heating networks are long-term projects with high investment needs. Thus, a professional project and quality management is essential in order to realize and operate plants successfully.”

**EFFICIENCY AND SUSTAINABLE SUCCESS THROUGH QUALITY MANAGEMENT**

Due to the lack of knowledge and experience with a new technology and the lack of quality standards, the design and implementation of biomass district heating plants was often inefficient and not quality oriented, which had a negative effect on the efficiency of the plants. For a long-term protection of a technical and thus economic and ecological successful plant operation, the quality management program klimaaktiv qm heizwerke was introduced with the following objectives:

- Security of a qualitative high value planning and technical design
- Efficient plant operation
- Low operation and maintenance costs
- High durability of the plant
- Low emissions
- Efficient funding

klimaaktiv qm heizwerke makes sure that the use of biomass for network-bound heat supply serves the increasing demands for environmentally friendly technology in the future. For the operators this means a minimization of the investment risks and safe revenues.



Biomass heating plant Kleinwalsertal

## STATUS QUO AND FUTURE CHALLENGES

**CURRENTLY THERE ARE MORE THAN 2,000 BIOMASS DISTRICT HEATING PLANTS IN AUSTRIA** that produce about 4,600 GWh renewable heat<sup>2</sup>. In addition, there are more than 100 active biomass cogeneration plants that produce both heat and power which is then fed into the district heating grid to supply industrial companies (e.g. drying chambers, pellets production, etc.). New biomass district heating plants are still built and existing heating plants and heating grids are constantly being enlarged in Austria by gaining new heat customers and expanding net lines.

The number of new construction projects has been declining for a couple of years. This is basically due to certain market saturation as a big number of plants cover a high level of supply in Austria. Moreover, cheap fossil energy keep potential heat customers from changing to biomass district heating. Nevertheless, Austria still bears the potential for biomass dis-

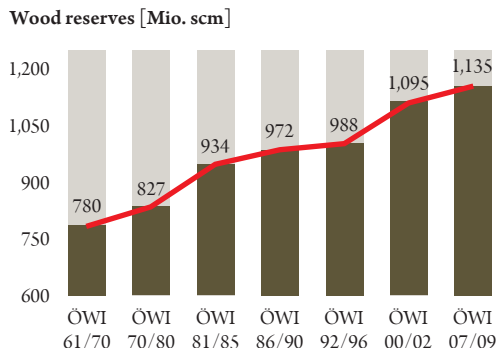
trict heating plants, the trend, however, is clearly towards, smaller plants for specific supply areas.

Since the bioenergy boom the situation on the heat market has also changed considerably. Especially the high insulation standards for new buildings and the thermal refurbishment have an effect on grid-based heat supply, as they result in a lower heat energy density in the supply areas and make district heat supply more difficult. Moreover, the offer of alternatives, such as small furnaces for firewood, wood chips, pellets or heat pumps has considerably increased.

### AVAILABILITY OF RAW MATERIALS

The wood resources in the country are needed for material-type use in saw, paper, board and wood processing industry and for energetic use for the production of heat and electricity. Due to sustainable forestry, more wood grows in Austria than needed. The wood supply increases constantly and un-

<sup>2</sup> Source: Basisdaten Bioenergie 2015, Austrian Biomass Association



Development of wood reserves based on the Austrian forest inventory since 1961

© BFW 2014 – ÖWI 2007/09

used wood reserves grow despite the increasing demand in energetic use. Based on a fuel and energy wood utilization of 245 PJ in 2014, 40% more wood could be provided for energetic use by mobilizing the owners of smaller forests<sup>3</sup>.

Despite existing reserves the re-growing energy sources must be used economically and sustainably. The strict efficiency standards of klimaaktiv qm heizwerke lead to a low-loss conversion and the provision of thermal energy and a lower and resource saving utilization of fuel.

### ECONOMIC FACTOR BIO-ENERGY

The Austrian bio-energy success story created many new enterprises in the promising bio-energy sector that successfully promote their products and services in Austria but especially on the international market. Moreover, the erection and the operation of new biomass heating plants create value and jobs in the region. In 2013 a primary total turnover of about 2.4 billion €, created 18,000 jobs and reduced the dependency on energy imports<sup>4</sup>. The specific research competencies built up in Austria and the existing technical and practical know-how in the sectors bio-energy and renewable energy guarantee a sustainable development of the bioenergy sector in Austria.

<sup>3</sup> Source: BFW 2014 – ÖWI 2007/09

<sup>4</sup> Source: Biermayer et al., Erneuerbare Energie in Zahlen 2014

### MARTINA SCHUSTER

Austrian Ministry of Environment,  
Head of Dept. for Energy and Economic Policy:

“Efficient biomass heating plants contribute significantly to energy transition. The challenge is to keep up with the technological development and the changes on the heat market.”

### SUSTAINABLE REGIONAL DEVELOPMENT

Biomass district heating plants and heating grids are important infrastructure projects with long-term focus that strengthen rural areas as a space for working and living. Moreover, they are promotionally effective for municipalities and especially for tourism areas concerning climate protection measures.

Biomass district heating plants guarantee the income for farmers and foresters through the supply of biomass fuel and the operation of heating plants.

Moreover, the supply of low-cost and renewable heat can enhance the foundation of new enterprises e.g. drying of agricultural products.

Biomass district heating plants serve as a model example and a flagship for energy transition. They promote energy consciousness of the local population by local events or guided tours through the heating plants. Biomass district heating plants can thus become the starting point for new projects in the sector energy efficiency and renewable energy in the region.

### CUTTING-EDGE TECHNOLOGY FROM AUSTRIA

Austrian enterprises are among the world's market leaders in the sector biomass combustion and boiler technology and produce important key elements for biomass district heating plants and heating grids. The expertise of Austrian research institutes support the enterprises and the sector in further technological development.

## OPTIMIZATION AND TECHNOLOGY DEVELOPMENT

In order to maintain the existing biomass district heating plants and to guarantee their economic competitiveness in the long run it is necessary to expand them in a target-oriented and sustainable way in combination with constant operational optimization. Regular monitoring of the most important operational parameters and key figures of heating plants and heating grids helps the operators to determine any improvement potential and to use it accordingly.

Austrian enterprises, innovative heating plant operators and especially research institutions promote the technological development of biomass district heating plants and heating grid technologies. The aim of this development is to increase the overall efficiency of the plants, to reduce the fuel input by using alternative and low-cost energy sources and to provide technological solutions for the supply of areas with low heat density. Current trends focus on the increasing use of solar thermal plants and flue gas condensation units in combination with heat pumps, the further development of combustion and regulation technologies, the development of innovative network technologies that enable a flexible grid topology and the integration of different energy sources. Another research works on the decrease of the temperature level of heating grids.

## WHAT WILL HAPPEN NEXT?

In the future significant effort will be required in order to exploit the existing potential of biomass district heating plants in Austria and to continue the bioenergy success story. Therefore, the quality and efficiency of the existing heating plants must be improved and their sustainable and targeted expansion promoted. Moreover it takes research, innovative

## HEINZ KOPETZ

President of the world biomass association:

“Biomass as stored solar energy is the heating source of the future. In order to carry out the energy transition, it is essential to introduce a climate protection fee for fossil fuels.”

concepts and technologies in order to guarantee a technically, economically and ecologically reasonable heating supply in the future.

The climate agreement concluded in Paris gives reason to hope that further measures for the realization of the energy transition will be taken and therefore the biomass district heating supply will be expanded in Austria. Austria could thus become a model example for other countries.

## WHY DO HEAT CUSTOMERS CHOOSE BIOMASS DISTRICT HEATING?

- Reliability
- Supply guarantee
- Comfort and service
- Regionality
- Costs
- Space saving
- Environment and climate protection



Heating plant Mallnitz





## QUALITY MANAGEMENT FOR BIOMASS HEATING PLANTS AND DISTRICT HEATING GRIDS

**QM HEIZWERKE** is a project-oriented quality management system for biomass heating plants and district heating grids, carried out within the Austrian climate initiative *klimaaktiv* of the Federal Ministry for Agriculture, Forestry, Environment and Water Management (BMLFUW).

The aim of the program is a considerable improvement of the technical quality and efficiency of the plants through accompanying quality control during the planning, construction and operational phase of a biomass district heating plant.

### THE QM-SYSTEM

The quality management (QM) system for biomass heating plants and district heating grids was designed in Switzerland and further developed by the international working group Quality Assurance Wood Combustion, consisting of experts from Austria, Germany and Switzerland. One result of this work was the publication series Quality Assurance Wood Combustion that comprises all important topics and quality criteria of the QM-systems.

The QM-system defines the entire planning and realization procedure of a biomass district heating project in the form of



### WORKING GROUP Quality Assurance Wood Combustion

#### Switzerland:

- Holzenergie Schweiz, with financial subsidy of the Federal Authority for Energy

#### Germany:

- College for Forestry in Rottenburg
- C.A.R.M.E.N. (Centrales Agrar-Rohstoff-Marketing- und Entwicklungs-Netzwerk e.V.)

#### Austria:

- AEE - Institute for Sustainable Technologies (AEE INTEC)



five milestones. Each milestone includes its specific quality requirements, responsibilities and necessary documents. An independent quality consultant accompanies the project on-site and on the basis of the required documents. This guarantees that a suitable concept is being realized and the plant is dimensioned in the best possible way. The Austrian version of the international quality management system was introduced throughout the country in 2006 and is compulsory within the country in the frame of the environmental support for all plants with a nominal thermal capacity of the biomass boilers of or exceeding 400 kW or whose grid length is or exceeds 1,000 meter. In case of plants <400 kW a simplified version of the quality management system (*qm kompakt*) is applied. This consists of a tool that performs an automated plausibility check based on the most important technical basic data of the plant and its heat consumers under consideration of the quality criteria.

Since 2014 AEE INTEC has been leading the program *klimaaktiv qm heizwerke* on behalf of the Austrian Ministry of Environment and has been responsible for the support and further training of the quality consultants, the planners and operators, the further development of the QM-System, the quality assurance, the know-how-transfer and the networking among all stakeholders.

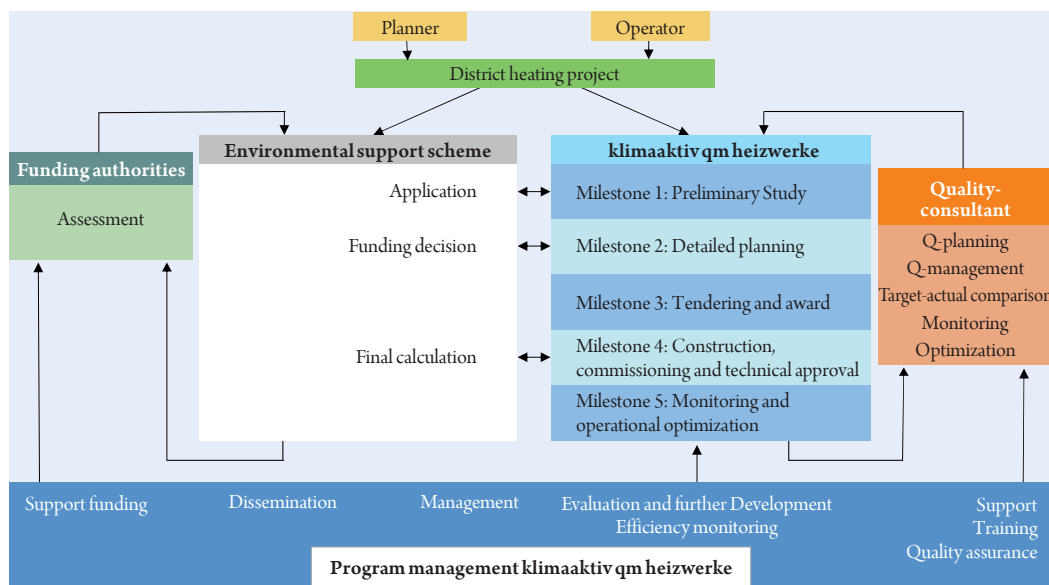
**THE QM HEATING PLANTS – DATABASE**

QM-procedures are managed with the help of the *klimaaktiv qm heizwerke* – database that describes the 5 milestones of the QM-procedure and that contains all relevant data and technical documents (plans, hydraulic schemes ...). The data bank also contains all detailed data of each heating consumer and annual operation reports including the most important operation data of every single plant. All participants in the project (operator, planner, quality consultant and funding agencies) have access to their project via a web-interface and can manage the entire QM-procedure via the database. The database is also used by the federal and provincial funding agencies in order to support the funding procedure.

All plant and operation data in the database also serve as an important basis for constant evaluation of the Austrian district heating plants and the documentation of any efficiency progress based on the *klimaaktiv qm heizwerke* quality standards.

**FACTS ABOUT THE DATABASE**

- Recorded plants and projects: 1,400 projects of 730 plants
- Total connected load of all projects: 3,360 MW
- Total route length of all projects: 3,400 km
- Number of supplied heat consumers: 50,000
- Number of operational reports: 1,500 operational reports of 400 plants



*Process organisation qm heizwerke and subsidy administration and interaction between program management and acting persons*

## OBJECTIVES

The main goals of klimaaktiv qm heizwerke is to increase the overall efficiency of new and existing biomass heating plants and district heating grids by guaranteeing high utilization rates of the heat production and low thermal loss of the heating grid. High efficiency and high-quality technical standards enable a reliable and low-maintenance operation and are the prerogatives for a sustainable economic operation. A suitable and perfectly dimensioned plant concept guarantees low-emissions in all operation phases.

Even if individual requirements of the QM-system as for example a comprehensive measurement equipment, data processing and control engineering and a thorough and comprehensive planning procedure might result in slightly higher investment costs, the optimal dimensioning of the heat production and heating grid based on the quality criteria klimaaktiv qm heizwerke will reduce the overall investment costs, especially the ongoing operating costs considerably. This contributes to the efficient and sustainable use of public funds for the promotion of biomass heating plants and district heating grids.

In order to increase the efficiency and to reduce the operating costs the QM-system includes the optimization of the plant. The operator can supervise the plant and find optimization improvements with relatively simple means and a few figures.

Other goals of the program are the national and international distribution of the quality management systems and the transfer of know-how in order to develop the bio energy sector sustainably and to avoid mistakes.

## APPLICATION IN OTHER COUNTRIES

The quality management system for biomass heating plants and district heating grids is compulsory, i.e. recommended nationwide in Austria and partly in Switzerland. In Germany the application is not compulsory, however, is offered on a voluntary basis.

### QM HEIZWERKE INTERNATIONAL

Interested parties from countries such as Canada, Japan, Norway, the USA, Italy and Slovenia have already collected information about the quality management system in order to introduce an adapted version suitable for the local frame conditions.

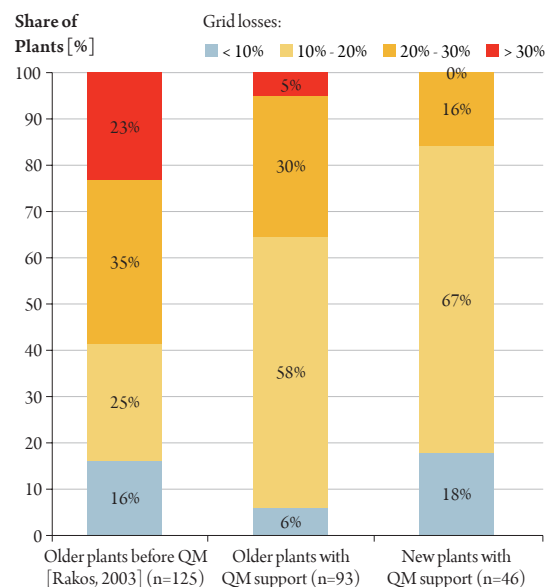
Austrian quality consultants have already accompanied the development and planning of similar projects on the spot in Canada and Japan.

Again and again the quality management arises great interest abroad. The Quality Assurance Wood Combustion endeavours to introduce the quality management in other countries in order to enable a sustainable development and a stronger use of biomass heating plants for a climate-neutral heat supply.

## ECONOMIC EFFICIENCY THROUGH QUALITY

The operation data of biomass heating plants and district heating grids that the quality management was applied for clearly shows that the plants' efficiency improved. New plants that were built after the introduction of klimaaktiv qm heizwerke show a considerably lower grid loss. This is also true for older plants whose enlargement has been accompanied by a quality consultant. The technical standards and recommendations of the quality management contributed to the fact that planning has become much more important and that plant concepts could be adapted much better to the specific frame conditions. Thereby plants could be operated with high efficiency and low emission totally independently from their current load status. The higher efficiency of the overall plant means less need in fuel, thus lower operating costs.

Ensuring high-quality performance, the use of a fuel range suitable for the selected combustion technology and the fulfillment of essential operation parameters contribute considerably to a longer lifecycle and lower maintenance of the plants. The effect of the quality management improves the economic success of the projects.



Comparison of grid losses of old and new plants with and without support of qm heizwerke

## CREATING AWARENESS

Creating awareness is a time-consuming long-term procedure. Through consequent education and information of operators and planners but also interest groups and funding agencies the goals and intentions of quality management has become well established.

## IT IS THE RESULT THAT COUNTS

The QM-system cannot consider all special cases, technical solutions and new developments. Consequently it is important to convey the basic ideas and goals — apart from the essential quality requirements — and to make the people involved aware of the quality issues. Despite a number of requirements and standards klimaaktiv qm heizwerke is flexible enough to realize own solutions and innovative ideas as long as they result in economic, efficient and sustainable heating plants and heating grids.

## EUROPEAN COURT OF AUDITORS



In a special report of the European Court of Auditors klimaaktiv qm heizwerke is mentioned as an example for a recommendable procedure for project monitoring and evaluation.



## MEANS AND SERVICES TO INCREASE THE EFFICIENCY

### PUBLICATION SERIES

#### Quality Assurance Wood Combustion



Publication series *Quality Assurance Wood Combustion*

The publication series *Quality Assurance Wood Combustion* was created by the international work group Quality Assurance Wood Combustion and forms the basis of the QM-system.

#### **Vol. 1: Q-guidelines**

Procedure and quality requirements of *qm heizwerke*

#### **Vol. 2: Standard-systems — part 1**

Collection of proven plant configurations

#### **Vol. 3: Sample tender for wood boilers — Version Switzerland**

Tender documents for Switzerland

#### **Vol. 4: Planning manual**

Description of the state-of-the-art of biomass heating plants

#### **Vol. 5: Standard-systems — part 2**

Collection of proven plant configurations

#### **Vol. 6: Tender guide for biomass-boilers — Version Austria**

Tender documents for Austria

### CONSULTING AND TRAINING

The *klimaaktiv qm heizwerke* team supports and guides the quality consultants in order to guarantee an efficient and effective application of the quality management in practice. It also organizes annual workshops for quality consultants. New quality consultants must prove their respective technical qualification and complete a comprehensive training that teaches the specific technical, economic and organizational requirements for quality management, essential for the job of a quality consultant. The training is also available for other interested persons for the purpose of further training. In order to disseminate new technological developments, innovative plant concepts and practical experience, a planers' and operators' information day is organized on an annual basis. Moreover, the latest results and findings of the *klimaaktiv qm heizwerke* program are presented in the frame of international special events. The *klimaaktiv qm heizwerke* team provides their experience to all interested persons and institutions and is available for any questions or consultations. If needed, the connection to experienced experts can be arranged.

### QUICK QUALITY CHECK (QQC)

QQC offers all operators of biomass heating plants and district heating grids, investors and funding agencies an innovative and cost-efficient service whose main goal is the sustainable and efficient operational optimization. Technical information about the plant's condition, necessary refurbishment measures and the optimization potential are developed by independent experts.

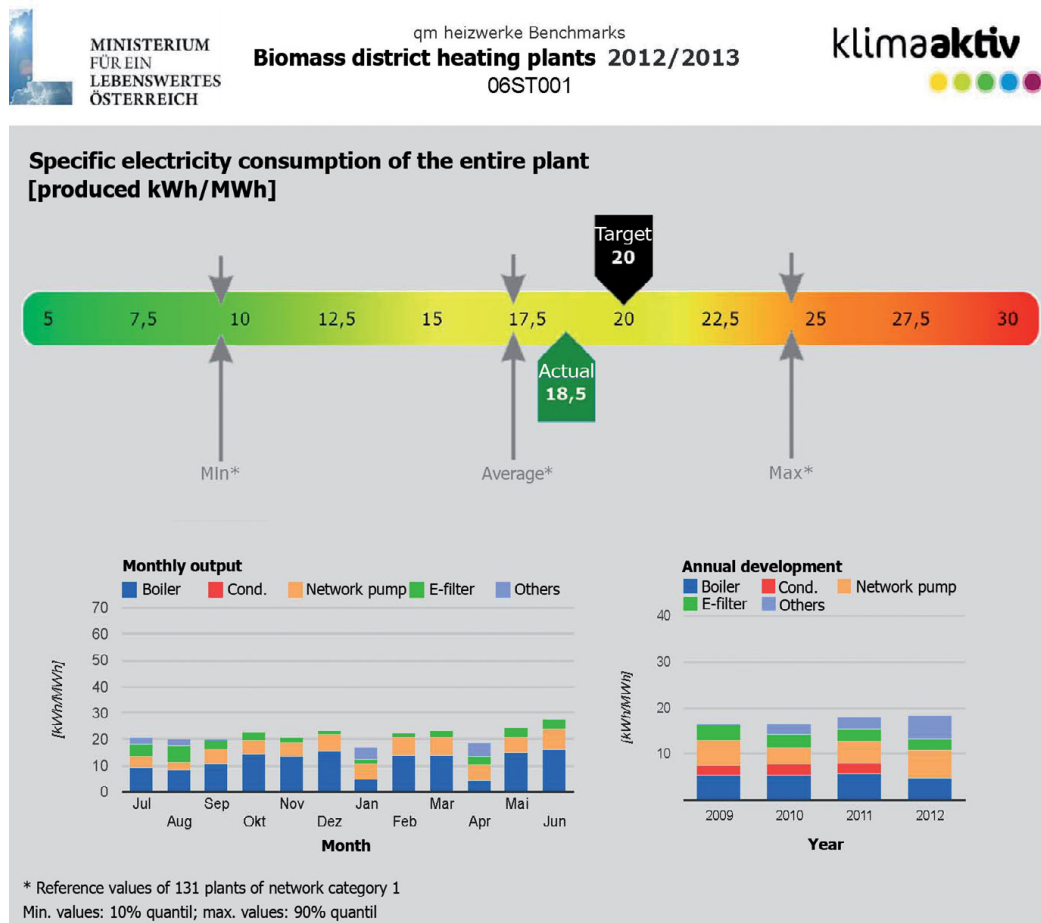
With regard to emissions, efficiency and quality of biomass district heating plants there is a easily accessible improvement potential and sustainable effects can be achieved through the realization of relatively simple measures. Within the frame of QQC and in the presence of the operator and his operational experience a competent one-day check of the entire plant is performed. The Quick-Quality-Check shows useful optimization measures and recommendations that amortize within a short period of time.

**THE QM HEIZWERKE – BENCHMARKS**

klimaaktiv qm heizwerke introduced a benchmarking-system for Austrian biomass heating plants and district heating grids. Therefore a method was developed that is used to calculate important key figures (benchmarks) on the basis of the annual operation reports and the data stored in the database of klimaaktiv qm heizwerke which are then compared with target and reference values of other heating plants. The individual benchmarks are clearly shown in a graph and include the indicators of a monthly and annual development of individual figures.

monitor and evaluate the operation data and thus improve the operation and the efficiency of his plant. In order to gain profound understanding for the benchmark results, each figure must be interpreted in the context of the specific frame and local conditions. Any deviations from target and comparison values must be questioned critically by the operator, as the operator himself must know best how and why deviations from target and comparison value occur and what optimization potentials exist. If necessary, it is recommended to discuss the results intensively and to determine any optimization potentials with the help of detailed plant monitoring supported by planers, quality consultants or other experts.

The benchmarks are evaluated on a regular basis, are then provided to the operators as a service and information and constitute a feedback of the QM-system to the operator. The klimaaktiv qm heizwerke benchmarks are a service of the program management of klimaaktiv qm heizwerke (AEE INTEC) and serve as an information pool for operators, planers and quality consultants. The aim is to present an overview with these benchmarks about the current and previous operation years and to motivate the operator to



Benchmark-evaluation for the specific electricity consumption of the entire plant

## THE AUSTRIAN FUNDING SYSTEM



### ENVIRONMENTAL SUPPORT IN AUSTRIA

The environmental support in Austria (UFI) is the main funding instrument of the federal government concerning environmental protection. The UFI offers a motivation to implement measures to avoid or reduce air pollution, climate relevant emissions, operational noise or hazardous waste. The funding consists of non-refundable investment subsidies.

The *Kommunkredit Public Consulting (KPC)* as the settlement agency consults applicants, accepts funding applications, checks the eligibility of the projects and develops a funding proposal for the Environmental Support Commission. The commission consults the Ministry of Environment in its funding decisions and the development of the funding guidelines. After the decision of the Minister of Environment, the KPC contacts the applicant, monitors the realization and releases the fund after a final calculation.

About 70 million Euros are available for environmental projects every year. In addition to this, the Federal governments

and the European Union offer co-financing funds. The major part of the funds (more than 90%) are invested in climate protection projects. In 2014 the implementation of renewable energy sources — first of all solid biomass — was accountable for about two thirds of the reduction of CO<sub>2</sub> emissions of 294,000 tons per year. Projected to the operating life 5.5 million tons of emissions per year can be avoided.

From the climate policy point of view the environmental support in Austria makes an essential contribution to reach the reduction targets of the Austrian climate strategy and the medium- and long-term goals of the European Union and the according duties of the member states (20-20-20-goals).

### FUNDING FOR BIOMASS DISTRICT HEATING PROJECTS

Since 1993 the funding offer for new constructions and expansions of biomass district heating projects has constantly been expanded and modernized. It includes the following project groups:

- Biomass heating plants,
- heat distribution grids for large-scale heat supply for third parties,
- replacement of boilers in biomass district heating plants,
- expansion and densification of district heating grids,
- optimization of district heating plants,
- hydraulic optimization of consumers and
- Biomass-cogeneration



Biomass cogeneration must have a fuel conversion efficiency of at least 60% and use at least 30% of the available heat.

The standard funding rate is 25 % of the environment-relevant investment costs, which can be increased to a maximum of 35 % by additional fees (sustainability fee for the purchase of regional wood chips and eligibility for EU-funding due to high efficiency).

Eligible are all companies, other entrepreneurial organizations, associations and cooperatives and religious denominations. Considering the motivation effect of these fundings, the application must be handed in before the start of the project (first legally binding order). The funding is only provided for projects whose investment costs exceed 10,000 Euros and where CO<sub>2</sub>-emission savings are at least 4 tons per year.

### ENVIRONMENTAL EFFECT

According to the goals of the environmental support for Austria the funded projects must show a positive and permanent environmental effect. In case of district heating projects the so-called “environmental effect” is mainly a CO<sub>2</sub>-emission reduction by the replacement or avoidance of fossil and thus environmentally harming energy sources. The dimension of the environmental effect is determined and identified by KPC in the course of the funding assessment based on the heat consumption structure and standard-CO<sub>2</sub>-emission factors.

In order to guarantee an appropriate ratio between the achieved CO<sub>2</sub>-reduction and the amount of invested funds, maximum amounts per reduced ton of CO<sub>2</sub> were determined for the individual funding areas (see [www.umweltfoerderung.at](http://www.umweltfoerderung.at)). The funding amount for a project is thus limited by the achieved environmental effect.

### TECHNICAL AND ECONOMICAL REQUIREMENTS

All funding projects are checked thoroughly by the settlement agency in the course of an assessment concerning its guarantee of a technically perfect and economically sustainable plant operation. The central parameter for the evaluation

#### ALEXANDRA AMERSTORFER Manager of the Kommunal Kredit Public Consulting GmbH:

“The high quality and efficiency requirements of klimaaktiv qm heizwerke and the funding criteria of the environmental support guarantee a sustainable and efficient utilization of the granted funds.”

of the quality of a district heating project is the gross utilization rate as a measure for the delivered heat with regard to the total fuel utilization that must show a value of minimum 75%. The network return temperature should be maximum 55°C. Another requirement for a positive assessment is the proof of guaranteed heat delivery of at least 75% of the heat via heat supply contracts. Biomass heating plants and district heating grids as from 400 kW or 1,000 m route lengths are subject to a quality management system for biomass heating plants (klimaaktiv qm heizwerke).

The aim is technical and economic optimization of existing and newly built district heating plants. The milestones in the frame of the QM-System are in close connection with the funding procedure and are partly requirements for the funding assessment, calculation and funding of the projects.

The prerogatives for a funding are not only the CO<sub>2</sub>-reduction achieved through the project, but also the compliance with performance related emission limits that go beyond the mandatory limits for dust and NO<sub>x</sub> defined by Austrian laws. Furthermore, the proof for the realization of the project and the fulfillment of the emission limits by means of a measurement certificates are required.

### FURTHER INFORMATION AND SUBMISSION

The funding application must be submitted before the beginning of the project (first legally binding offer) via an On-line-platform of the KPC ([www.umweltfoerderung.at](http://www.umweltfoerderung.at)). This homepage holds all forms necessary for submittance and calculation. Information sheets offer a checklist and important tips.



## BEST PRACTICE EXAMPLES FOR AUSTRIAN BIOMASS HEATING PLANTS

### MATTSEE, SALZBURG

|   |          |
|---|----------|
| Total output of installed biomass boilers | 2,550 kW |
| Thermal solar plant                       | 180 kW   |
| Grid length                               | 3,000 m  |
| Nominal heat load of consumers            | 2,300 kW |
| Number of consumers                       | 48       |
| Initial operation year                    | 2009     |

The heat production throughout the year in the heating plant Mattsee is performed with two biomass boilers in combination with a flue gas condensation plant. A biomass boiler is executed as a small boiler in order to cover low load operation and especially to co-operate efficiently with the solar thermal plant integrated in the heating plant. An oil-fired boiler serves as a back-up.

The very compact execution with utilization of the hillside location, the maximum fuel utilization through a flue gas con-



Heating plant Mattsee

densation plant and a solar supported heat production makes the biomass heating plant Mattsee an extraordinary best-practice-example. Despite the high linear heat density the route was optimized without any compromises and the tubes were chosen according to the highest possible insulation standard in order to minimize the heat loss.

### KRUMPENDORF, CARINTHIA



Heating plant Krumpendorf

|   |          |
|---|----------|
| Total output of installed biomass boilers | 2.000 kW |
| Heat pump                                 | 275 kW   |
| Thermal solar plant                       | 134 kW   |
| Grid length                               | 9.600 m  |
| Nominal heat load of consumers            | 7.600 kW |
| Number of consumers                       | 160      |
| Initial operation year                    | 2014     |

The biomass heating plant of the *BC Regionalwärme Krumpendorf* focuses on an innovative plant concept consisting of two biomass boilers with a suitable split of the heat output, a flue gas condensation plant, a thermal solar plant a heat pump and an oil-fired boiler as a back-up. Accordingly it takes a complex hydraulic system, heat storages for different temperature levels for the load management, the optimal use of individual sources and an intelligent plant control system. Moreover, the innovation center was added to the heating plant that is supplied with electricity via the own 10 kW<sub>p</sub> PV-plant. The biomass heating plant Krumpendorf is a best-practice example for the innovation power of Austrian engineers and plant operators that leads to a continuous improvement of Austrian biomass heating plants.

#### JOHANN HAFNER, BC Regionalwärme Krumpendorf GmbH

“qm heizwerke guarantees that the plant is an example for high-quality planning and technical implementation.”

**HITZENDORF, STYRIA**

Heating plant Hitzendorf

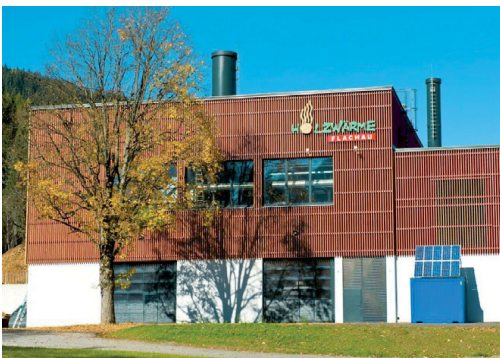
|   |          |
|---|----------|
| Total output of installed biomass boilers | 850 kW   |
| Grid length                               | 2,000 m  |
| Nominal heat load of consumers            | 1,620 kW |
| Number of consumers                       | 25       |
| Initial operation year                    | 2005     |

The biomass heating plant in Hitzendorf produces energy in two biomass boilers with different output, the smaller of which is used during the summer, but also during the winter in case of peak load. An oil-fired boiler serves as back-up that is hardly ever used thanks to the excellent plant management efficient operation (< 1 % of the production). For load balancing, a heat storage tank with 12 m<sup>3</sup> is installed.

The biomass heating plant in Hitzendorf is operated by an agricultural cooperative with 43 members and is an excellent example for a successful realization of a district heating system in a rural community based on correct design and operation management. Constant optimization measures and the owners' open-mindedness made the heating plant famous well beyond the Austrian borders.

**HANS REICHT****Bioenergie Hitzendorf regGenmbH**

"The efficiency of the plant must constantly be increased in terms of profitability. A regular monitoring and evaluation of operational data and the *qm heizwerke* database are therefore the basis."

**FLACHAU, SALZBURG**

Heating plant Flachau

|   |           |
|---|-----------|
| Total output of installed biomass boilers | 7,000 kW  |
| Heat pump                                 | 1,270 kW  |
| Flue gas condensation                     | 1,400 kW  |
| Grid length                               | 25,000 m  |
| Nominal heat load of consumers            | 23,000 kW |
| Number of consumers                       | 381       |
| Initial operation year                    | 2007      |

The biomass heating plant of the *Holzwärme Flachau GmbH* was originally built with two biomass boilers, one flue gas condensation plant and one oil-fired peak load boiler. The heating plant and the district heating grid were constantly expanded. In the course of this expansion and on the basis of the expertise prepared by a team of experts, investments were made into optimization measures in order to improve the plant's efficiency and profitability. Today, the biomass heating plant in Flachau uses a combination of a flue gas condensation unit and an industry heat pump in addition to the biomass boilers, a modern and innovative technology to increase the efficiency and to reduce the fuel input. Heat storage tanks were installed for the load management. The biomass district heating plant Flachau is a showpiece project concerning energy efficiency and the careful use of resources and shows impressively the outcome of consequent optimization measures.

**GERHARD LÖFFLER****Province of Salzburg**

"*Holzwärme Flachau* is a showpiece project. It demonstrates the potential for improved operation through well-planned constant optimization procedures, based on valid operation data as provided by *klimaaktiv qm heizwerke*."

## WIESELBURG, NIEDERÖSTERREICH



Heating plant Wieselburg

|   |          |
|---|----------|
| Total output of installed biomass boilers | 2,600 kW |
| Grid length                               | 2,000 m  |
| Nominal heat load of consumers            | 2,700 kW |
| Number of consumers                       | 24       |
| Initial operation year                    | 2007     |

**MARTIN KERSCHBAUMER**  
**BIOWÄRME FJ Anlagen-BetriebsgmbH**

“The efforts of the BMLFUW to establish alternative forms of energy does not only reduce CO<sub>2</sub>-emission, but also promotes the regional added value and thus the development of rural areas.”

The *BIOWÄRME FJ Anlagen-BetriebsgmbH* operates a two-boiler plant with a suitable split of the heat output rates, a 22 m<sup>3</sup> heat storage tank and it operates without an additional fossil-fired boiler.

The biomass district heating plant Wieselburg was developed with the intention to construct a showpiece project on the plot of the research center Francisco Josephinum and to supply the educational institution and all neighbouring buildings with renewable heat. The heating plant serves as an excellent training center for future bio energy experts and demonstrates that successful operation of heating plant and excellent benchmarks can be achieved with simple plant concepts simply by keeping the basic quality standards.

## RANKWEIL, VORARLBERG

|   |          |
|---|----------|
| Total output of installed biomass boilers | 2,700 kW |
| Grid length                               | 5,400 m  |
| Nominal heat load of consumers            | 5,620 kW |
| Number of consumers                       | 102      |
| Initial operation year                    | 2000     |



Heating plant Rankweil

The *Biomasse Wärmeversorgung Rankweil GmbH* operates a two-boiler plant with an additional oil-fired boiler to cover the peak load and as a back-up. Additionally, the plant concept also includes a heat storage.

Before the biomass heat supply of Rankweil could be built, a lot of work had to be put into confidence building measures, even though good preconditions with regard to the heat sale potential were given. After two extension stages the owners proved that they were willing to optimize the operation without any compromises. The success of the measures has already shown, but this was only possible thanks to the unbreakable will of the players and the active involvement of experts. The carefully planned and realized modifications and extensions and the constant monitoring and optimization of the procedure make the biomass district heating plant Rankweil an absolute showpiece project.

## BRÜCKL, CARINTHIA



Heating plant Brückl

|   |          |
|---|----------|
| Total output of installed biomass boilers | 2,000 kW |
| Grid length                               | 5,500 m  |
| Nominal heat load of consumers            | 4,100 kW |
| Number of consumers                       | 83       |
| Initial operation year                    | 2012     |

## HARALD KAUFMANN

nahwaerme.at - Energiecontracting GmbH

“A high-quality planning and execution, conscientious operation, open-mindedness towards technological development in combination with long-term experience and a strong local anchoring are the key elements for the success of our heating plant.”

The *HSH Nahwärme Brückl GmbH* operates a solid biomass heating plant based on a simple but conclusive overall concept.

The plant consists of two biomass boilers and an oil-fired back-up-boiler. One of the biomass boilers is a small-scale boiler in order to guarantee efficient and low-emission operation during low load periods.

The simple but effective concept of the plant, its high-quality design and excellent benchmarks make this plant a show-piece project. Characteristic for this project is a 50 kW<sub>p</sub> photovoltaic plant on the South-side-roof of the fuel storage hall that covers the major part of the electricity demand of the heating plant throughout the year.

## STEGERSBACH, BURGENLAND

|   |          |
|---|----------|
| Total output of installed biomass boilers | 4,000 kW |
| Grid length                               | 1,800 m  |
| Nominal heat load of consumers            | 5,560 kW |
| Number of consumers                       | 5        |
| Initial operation year                    | 2013     |



Biomass heating plant Stegersbach

The biomass heating plant Stegersbach is operated by the *Bioenergie Wärmeservice GmbH* and is an example for a well-planned and consequently realized enterprise strategy for successfully building and operating biomass district heating plants. Meanwhile the company does all the planning, supervision and maintenance of the plant themselves, and employs a special team for these tasks. Their heating plants demonstrate high-level standardization and thus reduced construction and maintenance costs. Additionally the heating plant Stegersbach includes a lot of in-company technological developments and implementation details that contribute to high plant efficiency and operational improvement. In the planning and construction phase special focus was put on the most important heat customers and supply areas that purchase the majority heat. The operator of the heating plant supports his key customers in optimizing their heating systems by providing his know how.

## SUCCESSFUL PROJECT DEVELOPMENT AND PLANNING BASIS

It is a long and difficult way from the idea to a finished biomass district heating plant. Important decisions that might influence essentially the long-term success of the project have to be made at a very early stage. After the erection of a plant possible planning mistakes can only be corrected at high financial costs or cannot be corrected at all. Accordingly, the planning and realization procedure is essential for any success.

### FRIEDRICH LETTNER Planer, quality consultant and expert

“High-quality planning is worth its money as it amortizes quickly due to optimized investment costs and low operation and maintenance costs on a long-term basis. It also guarantees best-possible environmental effects and a smooth plant operation.”

### PROJECT DEVELOPMENT

The trigger for the erection of biomass district heating plants can be high energy costs, old heating systems, the new construction of buildings or regional climate protection initiatives of farmers and foresters, municipalities or private persons. The information and education through public institutions, energy agencies and interest groups play a decisive role. In the course of the project development the following information must be collected:

- Data of potential heat consumers
  - Type (apartment house, hotel, hospital, school.)
  - existing heating system
  - nominal load rate and heat demand
  - consumers interest in connecting to the district heating grid
- Aerial image of the supply area
- Possible plant locations
- Supporter of the projects (municipality, ...)
- Available fuel
- Possible funding
- Basic legal requirements

Experienced experts have methods and tools to estimate the heat demand and to define promising supply areas. On the basis of these data they can then decide whether a project idea shall be pursued and a detailed feasibility study made.

### FEASIBILITY STUDY

A feasibility study shall define the technical and economic realizability of a bio-energy project and create a profound decision basis whether a plant shall be built or not. The feasibility study is the task of professional and experienced planners and includes the following:

- Heat demand inquiry
- Pre-planning of the heating grid
- Fuel supply concept
- Technical conception and dimensioning of heating plant
- Mass and energy balance
- Economic assessment

Starting point for the overall planning process is the heat demand inquiry where all relevant data of all buildings and objects in the planned supply area are assessed and the plausibility checked. In order to get a reliable result the heat consumption data of several years, the consumers' behavior and the capacity utilization of hotels, hospitals, shops and industry, the thermal refurbishment of buildings and the future development of the supply areas must be taken into consideration.

The concept for the heating plant includes the determination of the type, the number and the size of the biomass boilers. Moreover, a fuel supply concept needs to be elaborated that defines the type and quantity of the biomass and the necessary storage and conveying equipment. This influences considerably the configuration and the dimension of the plant and the selection of the combustion and boiler technology.

During the pre-planning phase the integration of flue gas condensation units and solar thermal plants, the utilization of

### HEAT DEMAND INQUIRY

The heat demand inquiry is the most important basis for the planning of heating plants and district heating grids.

The quality management system includes directions and recommendations concerning the assessable data and their evaluation. A free calculation tool can be used by the quality consultants to evaluate the results of the heat demand inquiry concerning plausibility.

exhaust heat and the viability of a biomass cogeneration plant are being investigated.

In a next step a complete mass and energy balance is prepared that shows the fuel and ash quantity, the emissions, the relevant heat quantity, the energy losses and the electricity demand.

All basics are now available in order to calculate the investment, operation and maintenance costs and to carry out a detailed economic evaluation. Apart from the calculation of the energy generation costs and a dynamic economic calculation a sensitivity analysis is recommended in order to demonstrate the influence of the essential factors such as investment costs or the sold heat quantity.

### DETAILED PLANNING, TENDERS AND ERECTION

Once an investment decision is made and the heat delivery has been contractually guaranteed with the majority of customers the detailed planning can start. First the technical concept of the feasibility study must be revised and the necessary technical foundation for a tender must be validated (dimensioning, set-up plan, hydraulic and P&I-scheme). The tender must define precisely the total scope of delivery and include a guarantee for heat outputs and quality and the provision of a comprehensive documentation of the plant. After the tender and the order of the plant components the planer completes the detailed planning, prepares the final plans and then the plant is built. A strict construction supervision helps to achieve high technical quality.

### MONITORING AND OPTIMIZATION

Despite the compliance with high quality standards deviations between the planning and the actual plant operation might occur. Moreover, the heating grid will constantly be expanded in the future. In order to guarantee an efficient and profitable operation, constant monitoring of the essential data is inevitable. Therefore suitable measurement equipment and a long-term storage of the operational data must be included in the plant equipment.

### SUPPORT FOR YOUR PROJECTS

The Austrian klimaaktiv qm heizwerke program supports the construction of district heating plants in provinces with little experience in bioenergy. Accordingly there is the possibility to provide information and know-how about the Austrian bioenergy success story in the frame of presentations, excursions or counseling interviews. klimaaktiv qm heizwerke also holds a comprehensive database that offers specific key figures and benchmarks for a relevant application. In case of specific interest or projects, contacts with planers and technology providers who can support the project development and realization can be established quickly and uncomplicatedly.

#### KEY FACTORS FOR SUCCESSFUL PROJECTS

- Reliable and detailed basic data
- Contractually guaranteed heat delivery
- Consideration of all frame conditions
- Consideration of future scenarios
- Comparison of several project options
- Specific integration of stakeholders
- Planning and construction supervision by experienced experts
- Implementation of approved and high-quality technology
- Strict quality management
- Monitoring and optimization

## FURTHER INFORMATION

### KLIMAAKTIV

[www.klimaaktiv.at](http://www.klimaaktiv.at)  
[www.klimaaktiv.at/qmheizwerke](http://www.klimaaktiv.at/qmheizwerke)  
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[www.qmholzheizwerke.at](http://www.qmholzheizwerke.at)  
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[www.aee-intec.at](http://www.aee-intec.at)

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### Lobbies

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[www.wko.at](http://www.wko.at)  
[www.biomasseverband.at](http://www.biomasseverband.at)  
[abina.biomasseverband.at](http://abina.biomasseverband.at)  
[www.aebiom.org](http://www.aebiom.org)  
[www.heizungs.org](http://www.heizungs.org)  
[www.propelllets.at](http://www.propelllets.at)

### Research and educational institutions

[www.bioenergy2020.eu](http://www.bioenergy2020.eu)  
[www.josephinum.at](http://www.josephinum.at)  
[www.aee-intec.at](http://www.aee-intec.at)  
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## ABOUT KLIMAAKTIV

**KLIMAAKTIV THE AUSTRIAN CLIMATE INITIATIVE** was launched by the “Federal Ministry of Agriculture, Forestry, Environment and Water Management”. With the core topics “Buildings”, “Saving Energy”, “Renewable energy” und “Mobility” it has been covering all central technological fields of a future oriented energy utilization since 2004. With the development of quality standards, active consulting, training and wide-spread information work the initiative makes a significant contribution to climate protection. **klimaaktiv** serves as a platform for initiatives of enterprises, provinces and municipalities, organizations and private individuals.

For more details see [www.klimaaktiv.at](http://www.klimaaktiv.at)

**klimaaktiv qm heizwerke** is a quality management program throughout Austria in order to improve the technical quality and efficiency of biomass heating plants and district heating grids. This is achieved by accompanying quality control during the planning, construction and operation phase. For consulting and further information see [www.klimaaktiv.at/qmheizwerke](http://www.klimaaktiv.at/qmheizwerke)

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