



ingenieurberatung

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hammerer-system-messtechnik

PROFI 4.0

Operation-management-software

for energy- and water supply companies

gas - water - electricity



documented maintenance

for supply systems with IT-assistance

digitization an standardization as a driver for process optimization

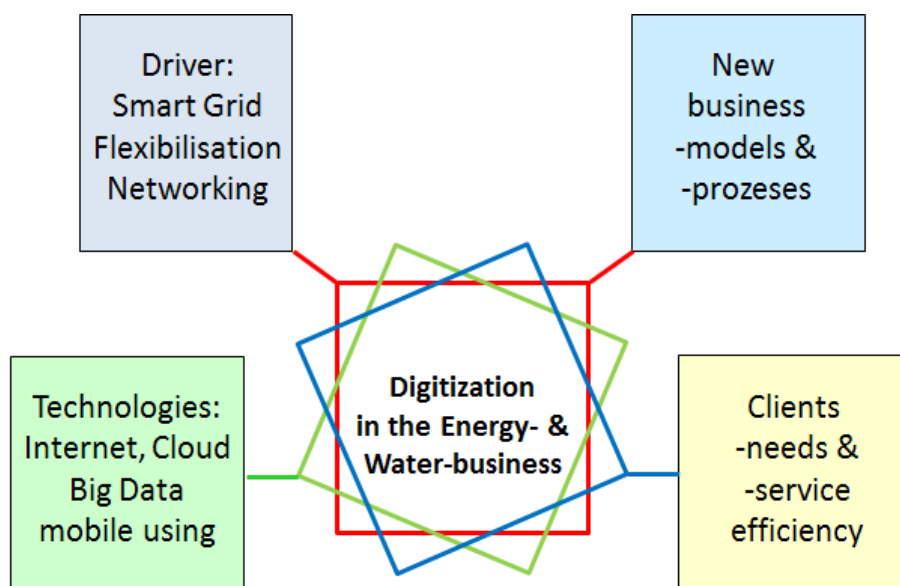


Energy & water 4.0 for energy- and water- supply companies

In the wake of the energy revolution, once fixed system and process limits (cross disciplines) of energy utilities and network operators break up. Networks evolve to different operators and service companies. Through the process of social change, awareness of energy and resource consumption by networking and transparency of supply and consumer bodies will change fundamentally.

These results in new business processes, based on data and information. At the same time the mega-trend of digitizing developed networking applications, business processes, and devices based on Internet technologies industrial and value creation across. Therefore, quality standards and efficiency are ostensibly to take into account.

This **change management** requires adjustments to the influences of the market, the environment and customer needs, through a strategy and real action together with the employees.



Based on the driving force behind digitization for the energy industry defines itself as a networking applications and business processes on the basis of Internet technologies (BDEW)

Driver of the energy revolution:

- digitisation & standardization
- indicator orientated maintenance
- customer service and business service
- work preparation and process control
- measurement for energy monitoring, energy disposition and power control



Value-oriented maintenance for the energy and water supply

Maintenance ensures that the functional State of a network or a system is maintained. The basic measures of maintenance are structured in the DIN 31051:

maintenance - inspection - repair - improvement

You strive for improvements of plants, processes and results of quality management. To do this, you set goals and measure the degree of target by indicators.

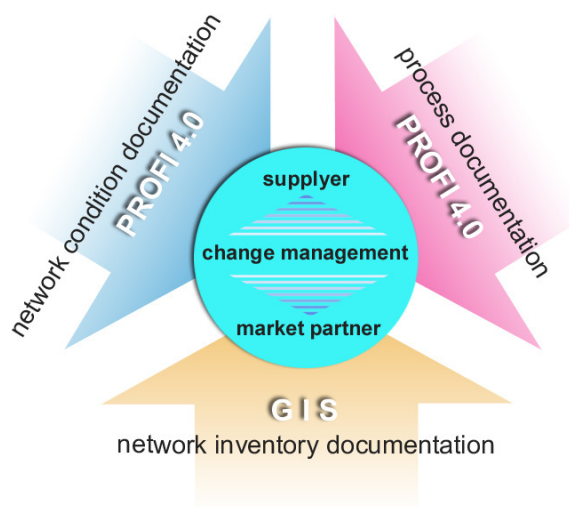
The demand for the maintenance of quality assurance (assessment of the condition of the supply networks and operating systems) are laid down in legal guidelines, regulations, and operating manual. By digitization and standardization of maintenance processes, strategies are developed, which have an optimal service life of supply-related resources to the target.

PROFI 4.0 offers a comfortable and transparent support for process control, maintenance & repairs for the sectors of gas, water and electricity to work scheduling, process tracking and data analysis in the context of energy & water 4.0.

Digital data, standardization of processes, and compare the result on the basis of indicators ensure an optimal security of supply and value retention of the plants.

Based on the inventory data in the GIS, State data of networks and systems and process data of the maintenance are the conditions at the turn of the energy revolution (change management) for the supply companies and strategic partners.

Goal of the maintenance with PROFI 4.0 is to harness the benefits of digitization and standardization for utilities and to generate added values.



PROFI modules as a management tool for maintenance processes



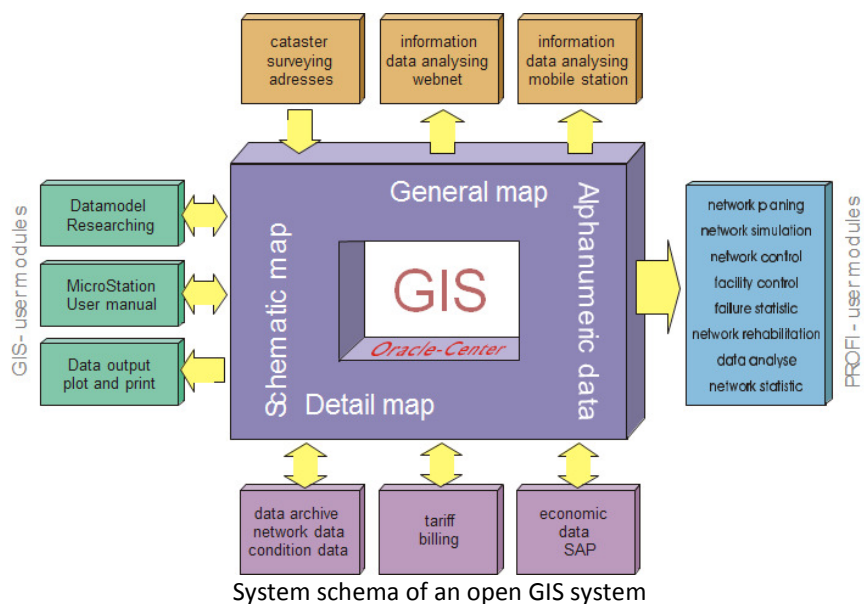
Line documentation using geographical information system GIS

The GIS consists of hardware, database, applications and data, and has the following responsibilities for the utilities to fulfil:

- Documentation of lines and installations according to location in various forms, standards, and content to the location detection, planning, documentation and process management
- Description of the lines and installations in alphanumeric data and object description for evaluation, condition assessment, renewal, and determine of the value of the investment
- Integration of digital data for work processes for planning, analysis, maintenance and business processes to optimize processes and maintenance of lines and plants

A digital GIS documentation is defined by the following exemplary criteria:

- Central data management and data storage for graphic and alphanumeric data
- Data consistency between graphical objects and alphanumeric information in all map forms
- Centrally defined network connections for all map forms in the data model
- Centrally controlled dynamic function assignments for defined objects (E.g. on/off)
- Central data management for various map forms (one date and one object centrally create, modify and manage)
- Spatial analysis on the basis of the digital maps
- Decentralized use of data of the experts for process editing
- Information system online and data input on mobile tablets
- Open interfaces for data export and data import





Requirements for PROFi 4.0

Basis for manage the maintenance at supply systems are the digital documentation GIS with the alphanumeric data of the objects as well as the previous inspection results from the past. The data exchange with other programs via interfaces, the influences on the process scheduling, business reporting and calculation of characteristic value. With mobile devices like tablets, Smartphones or mobile PC's work are supported in the field. The data are stored in the archive and are available for long term evaluation available. Thus priorities about vulnerabilities can quickly identify and establish measures for more inspections or replacements.

Advantages and benefits of PROFi 4.0

- Central data management / Client server architecture
- Comfortable interface to the graphical and alphanumeric GIS-data
- Mobile data recording in the field
- Data collection of local operation data from data logger
- Simple and intuitive operation of the mobile PC`s or tablets
- Online data collection and synchronization with the central data (server)
- Detailed permission system on basis GIS standard
- Local evaluation of the collected data to control of the maintenance activities
- Quality assurance of geographical objects and alphanumeric data in the GIS
- Work preparation modules for the inspection work
- Work order generation on the basis of inspection results
- Running on standard hardware and standard operating systems



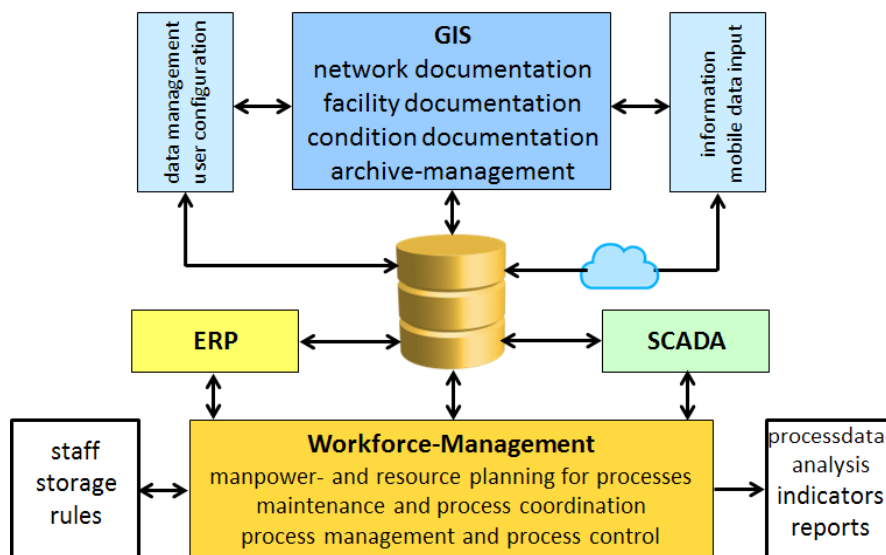
Graphical management with colored representation of the objects to be checked at the Smartphone



Process management with PROFI 4.0

Energy & water 4.0 through digitization and standardization significantly affects the operational management of the processes of maintenance in utilities. Most of the processes for planning, construction works and maintenance have a high level of routine and can be carried in a workflow standardized and documented. For this, a modern IT with mobile devices is required for direct data input and support for disturbance management. Litigation be accessed via interfaces to the data of the central IT- systems, so that for all applications the data are consistently available.

The goal to make use of the advantages of digital systems for utilities and consumers within the framework of quality management based on existing data.



IT-Struktur für moderne Instandhaltungsprozesse

Influences on the future organization in utilities (energy and water 4.0)

- Digitization** Centralized and consistent management of data structure on the supply systems, customers and processes allows a rapid, transparent and economic process and customer service
- Standardization** A large part of the processes have a high equality and routine level and these can be calculated according to a predetermined scheme as standard transparent and consistent operated
- Indicator management** Based on digital data and digital process control parameters can be made for the relevant processes, which allow a reliable calculation and transparent time management of the activity to be undertaken



Maintenance processes in energy & water 4.0

Service and maintenance are very important in utilities, fulfil the network and plants trouble-free operation. Legislators and the sector associations have created guidelines, regulations and recommendations that describe approaches and test ways. Most of the processes for planning, construction, service and maintenance have a high equality and routine level and can be carried in a workflow, from the identification of needs standardized preparation up to the condition assessment and documented.

IH-Prozesse	Sparten		
	Wasser	Gas	Strom
Störmeldungen	✓	✓	✓
Schadensdaten	✓	✓	✓
Leitungs- Netzprüfung	✓	✓	✓
Armaturenprüfung	✓	✓	✓
Netzstationen			✓
Regelstationen		✓	
Versorgungsunterbrechung		✓	✓
Wasseranlagen	✓		
Leitungsspülung	✓		
Kundenanlagen	✓	✓	✓
Leitungsbau	✓	✓	✓
Reparaturen	✓	✓	✓
Erneuerungen	✓	✓	✓

Uniformity of process reviews of all divisions

Programme- module error message as part of the customer service

An essential part of customer service is to provide a point of contact for the customer in the event of a fault or a desire at the complaints, requests or information can be dumped. From the centralised information, the unit can be use to detect vulnerabilities and problems of supply and initiated measures to eliminate. In the energy supply must errors, as they lead to supply disruptions, documented and reported for comparative statistics on the regulator. Characteristic indicators of the supply availability are SAIDI (characteristic value for average supply interruption per end user) and CAIDI (factor for the reliability of the supply).

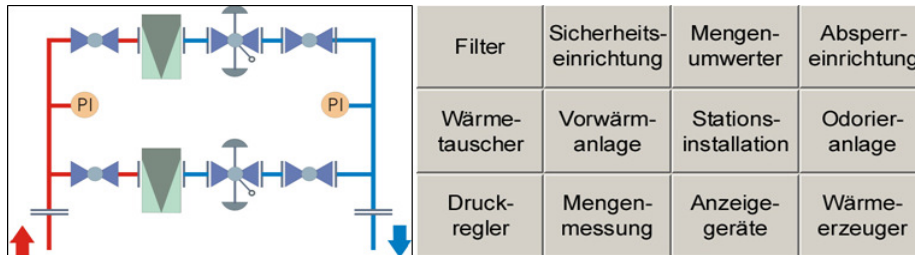
Störmeldung	Sparten			REGISTRATUR						MELDER		PROBLEM	
	Wasser	Gas	Strom	Sparte	Melde-Nr.	Tag der Meldung	Uhrzeit	Angenommen von	Angenommen durch	Name	Telefon	Beschreibung	Anlageteil
Datum				W	18066	13.12.2015	09:03	Huber	Tel.	Hinzen	3682-14	Wasseraustritt	Versorgungsleitung
Melder				W	18067	13.12.2015	09:21	Huber	Tel.	Stanke	283122	Druckmangel	Installation
Ort des Problems				G	18068	13.12.2015	10:14	Huber	Tel.	Dogan	3682-11	Gasgeruch	Zähler
Problembeschreibung				S	18069	13.12.2015	11:21	Huber	Tel.	Hebgen	3682-21	Ausfall KV/Stat	KVS 348
Empfehlung				W	18070	13.12.2015	12:03	Overbeck	Tel.	Müller	210983	Trübung	Anschlussleitung
Priorität				G	18071	13.12.2015	14:36	Overbeck	Tel.	Pittgens	3682-22	KeinGas	Installation
Rückruf				W	18072	13.12.2015	15:01	Overbeck	Tel.	Müller	210983	Wasseraustritt	Anschlussleitung
Weiterleitung				S	18073	13.12.2015	15:33	Overbeck	Tel.	Hofmann	363725	Kein Strom	Installation
Erledigung Datum/Abt.													
Erledigung Protokoll-Nr.													

Mapping the fault message to the appropriate divisions and evaluation list



Programme-module gas pressure control plant

In addition to the management of the installations, the pressure regulator are checked, keep constant the output pressure for the subsequent pipeline network. Other visual and functional checks of the installations must be provided and documented for the legislature.

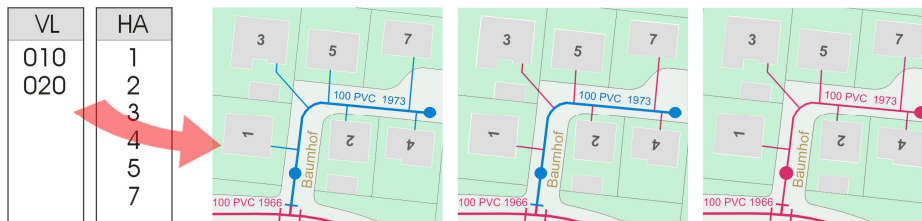


Schema of a gas pressure control plant

Inspection groups in PROFI

Programme-modul documented gas network inspection

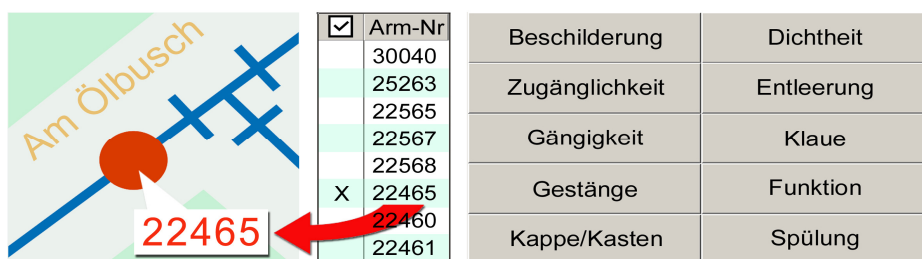
The gas pipe network inspection must be documented for reasons of transparency and security. The service pipes in the GIS are associated with the pipe sections. The pipe sections of supply pipes and the service pipes can be inspected separately individually or all at once. After checking and saving the the objects are colored visualized in the GIS.



Selection of objects of verification and visualization after inspection

Programme-module fitting inspection (gas and water)

The existing fittings in gas and water pipe network must be checked for findability, accessibility, functionality, and other criteria, so that in the case of damage or operational activities the fittings functional and reliable are available. Application processes in conjunction with fittings are repairs, shut-offs, pipe washing and fire services (water).



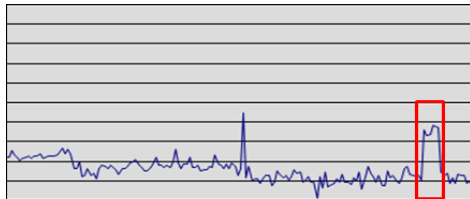
Selected and visualized hydrant in the GIS with fittings-inspection groups in PROFI 4.0



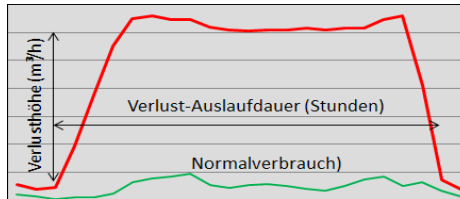
Programme-module water loss-monitoring

The duration of the leaks is the essential criteria which influences the level of water losses.

Monitoring the amount of inflow into a network district is a parameter to identify the origin and the history of the water losses and to initiate measures for detection and localization. The leak detection is determined using the known acoustic techniques (correlation, ground microphone, ...).



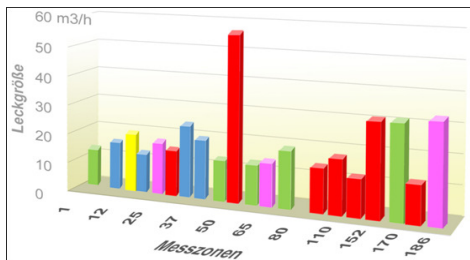
Daily hours- inflow recording for 6 months



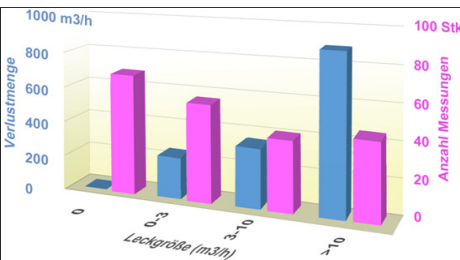
level and duration of the amount of the loss

Programme-module water loss-monitoring for big networks

The distribution network is divided into measurement zones by closing the valves and checked by means of mobile flow measurement. Parameters to optimize the review rhythms in measuring zones and thus reduce the flow times are the level of the observed amounts of water losses.



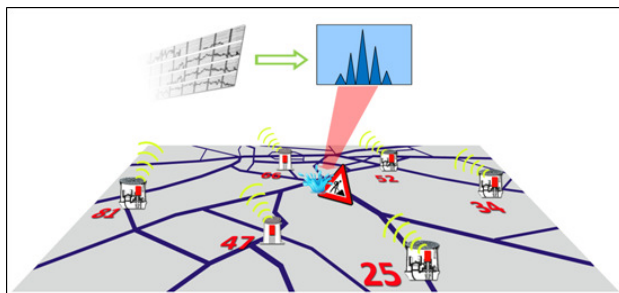
Measurements with loss levels > 10 m³/h



number of measurements with amounts of loss and water losses totals

Programme-module acoustic water loss monitoring by sound logger

Acoustic monitoring of the distribution networks, preferably metallic pipes, leak noise are detected by spreading along the pipes and stored. The sounds are transmitted regularly, so the origin and development of the leaks is narrowed. The defined pipeline segments are automatically recorded in the GIS and the leaks can be located.

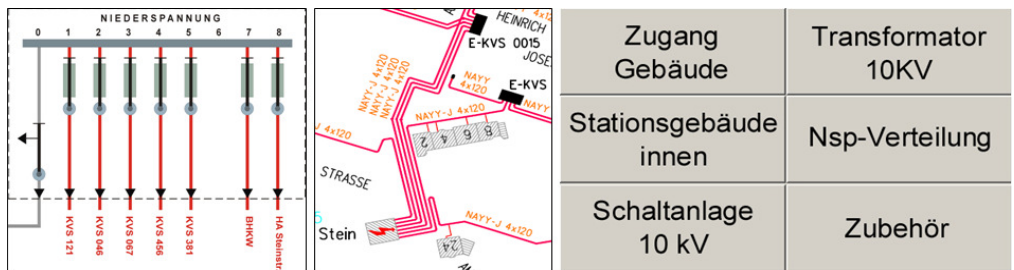


Positions of the noise logger, signal transmission, localization of the leak and visualization in GIS



Programme-module electricity power station

With PROFI 4.0, the service expert with the tablet can call the stations to see the position in the GIS. The connections of the cables to the clamps and the cable types are checked for correctness. The power switch can be operated from the tablet for switching. For condition assessment, the individual test modules will be selected and completed the set questions. The stored results will be sent directly to the server by Internet.



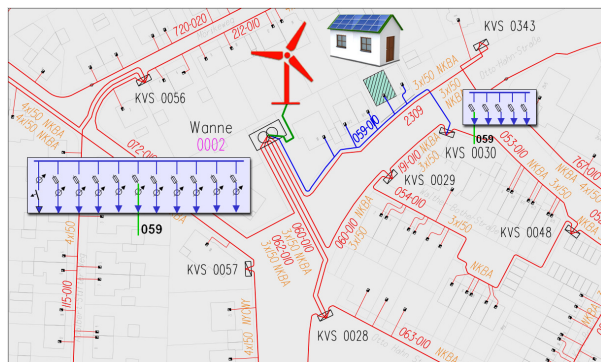
Schema of a power station with schematic NSP.

Inspection groups in PROFI 4.0

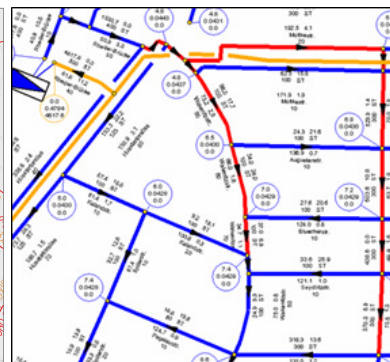
Network analysis (gas-, water- and electricity networks)

Distribution networks of all supply sectors are critical infrastructures and at risk in terms of changed network loads, outages and disturbances. Network analyses are used mainly to determine the supply reserves and deficits and thus represent the reliability of supply. On the basis of the GIS data, computing network models created and identified various impact scenarios.

In the energy supply, the load and power flows are influenced by factors such as consumption and 'new' single quantities of inflow. Measurements and analyses are an aid to determine the loads and load profiles of supply and assess. Network analysis programs provide valuable information for optimal single exit points and maximum feeding body for a stable supply and safe operation. Thus, the challenges of the energy revolution are supported and are the basis for planning, modernisation and maintenance investments.



Network analysis of a energy network with visualisation the result in the GIS



Network analysis gas network with result visualization in GIS of the flow velocities in the pipes



Programme-module damage database (gas-, water- and electricity supply systems)

Damage- and repair data show the state of lines and plants and is used to determine vulnerabilities and assessment of the substance of the supply system. The results will be used for investments in renovations and selective leak detection. The damage data will be evaluated in lists, tables, graphic parameters, indicators and if necessary visualized in GIS.

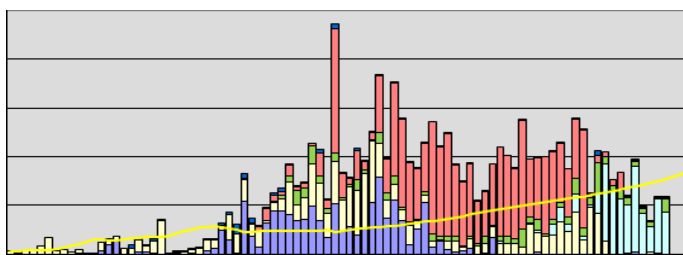


Evaluation of damage data in lists, graphics, and property values in the streets with visualization in GIS

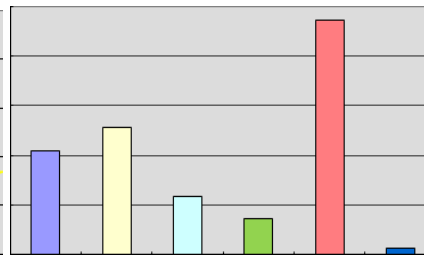
Programme-module rehabilitation of supply network (gas-, water- and electricity supply systems)

Lines, stations and plants of supply systems are objects to natural aging and stress wear, must be renewed at the end of life. Through systematic documentation of inventory, condition and other data priorities for the renewal of lines, stations and facilities can be evaluated, taking into account local factors affecting. The ageing and deterioration of lines and plants increases the risk of supply damages and the associated technical, economic and image related problems.

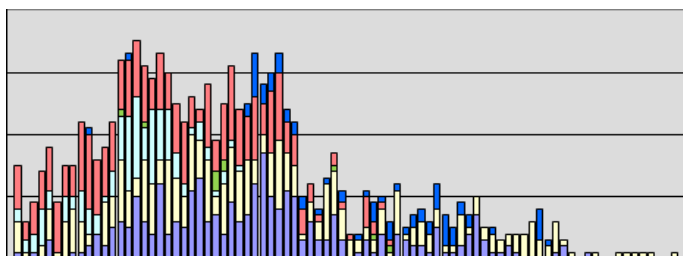
Reviews for renewals are determined with the existing data.



Line inventory for materials and aging



Line materials and laid lengths



Damage to materials and construction years

Kriterien	Priorität	Beurteilung	Bewertung
Schadensrate			
Leitungsmaterial			
Leitungsalter			
Bedeutung der Leitung			
Hausanschlussdichte			
Untergrund			
Abschreibung			
Summe Bewertung	$\Sigma = 100$	$B = 1 - 100$	$\Sigma * B$

assessment matrix for renewal priorities



Services for energy- and water utilities

- Support to the implementation of change management
 - Organizational adjustments to modern operational management at energy & water 4.0
 - Digitalization and standardization of processes for the utilization of value creation
 - Development, introduction and update of geographic information systems GIS to the documentation, planning and maintenance of water -, gas - and electricity networks
- Development and introduction of a indicator-oriented maintenance system
 - Planning, inspection and documentation of objects and derivation of measures
 - Network analysis of gas -, water - and electricity grids to the strength-, weakness-discovery
- Consulting, introduction and implementation of services
 - Reduction of energy costs
 - Reduction the level of water losses
 - Renewal strategy for line systems, stations and facilities
 - Investment control through cross disciplines
 - Asset management strategy for utility management and staff motivation
- Delivery of programs for the operation management
 - Geographic information systems GIS
 - Process control for maintenance with PROFI 4.0
 - Condition assessment of lining, stations and facilities with PROFI 4.0
- Establish of studies and consultations for modernization and investment reviews



with PROFI 4.0 to success!