# hammerer-system-messtechnik
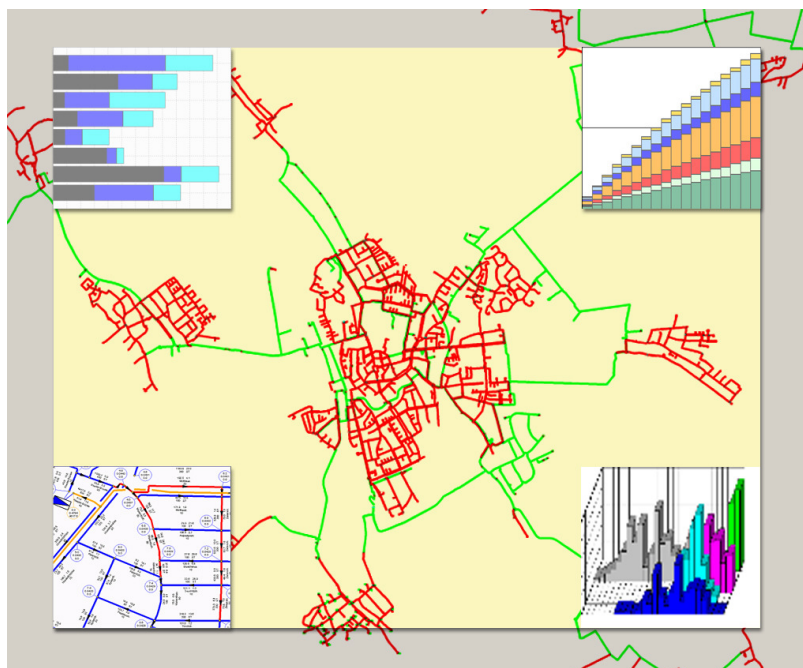
## Model analysis
## for gas distribution networks for the
## support the efficiency assessment
## by gas distribution operators

**Costs of the gas distribution networks**
**Costs in term of load structure**
**Area properties and planning requirements**
**Efficiency assessment of target networks**



Klagenfurt - Düsseldorf, 30.11.2010

## 1. Adjustment pressures or telling of a gas distribution system

- ➢ Efficiency pressure by the regulator
- ➢ Cost pressures by the owner of the network
- ➢ Cost pressure due to the competition
- ➢ Safety standards and the public
- ➢ Modernization pressure by the State of the art
- ➢ Flexibility of performance by the market dynamics

## 2. Tools for planning the grid adaptation

- ➢ Network documentation by GIS
- ➢ Real pipe network calculation

  modeling, calculation, measurement and calibration
- ➢ Consistent maintenance planning

  monitoring, inspection, repair
- ➢ Risikoorientierte renewal planning
- ➢ Target network discovery
- ➢ Target system implementation
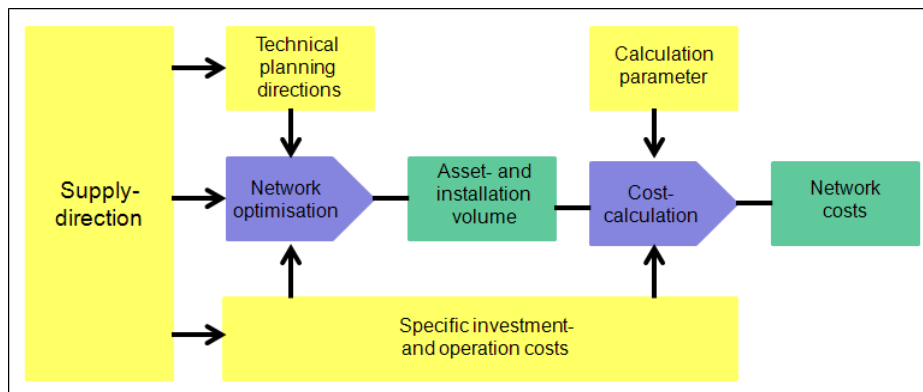
Basic model structure of analytical cost models

## 3. Request to a target network

- ➢ A target network must
    - o cover the current and future supply item
    - o must be for realisation
    - o meet the technical, safety technical, operational and normative specifications (standard and assumptions)
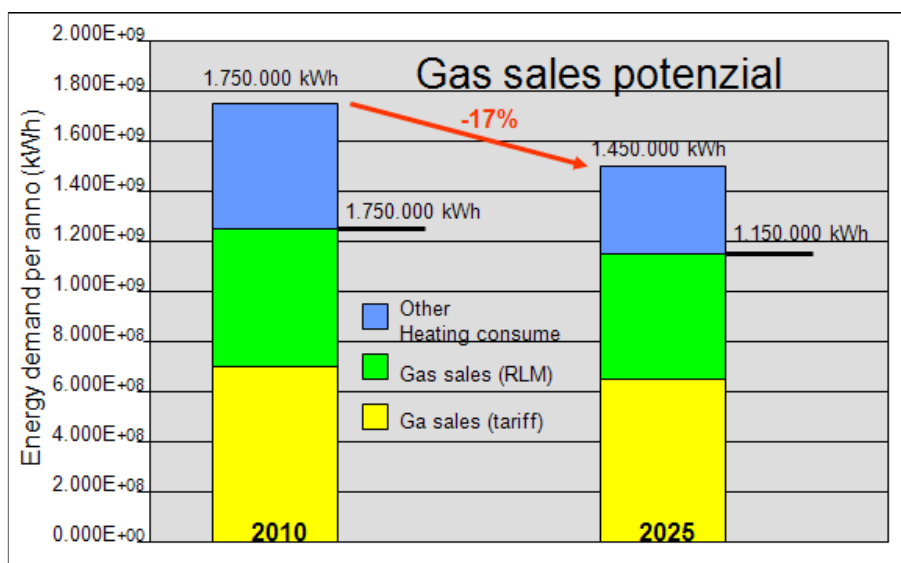
- ➢ A target network includes
    - o Minimiced quantity structure
    - o Minimiced recovery costs
    - o Minimiced network costs (Investments and operating costs)
- ➢ Points out the quantity structure of a target network
    - o the necessary pipelines
    - o the need pipe diameters
    - o the location of inflow works
    - o the provision of planned alternative faults
    
      related costs and number of service pipes for gas model networks

## 4. Important criteria within the target network planning

- ➢ Network costs
- ➢ Operating expenses
- ➢ Security criteria n-1 (the target network must compensate an peak load serious incident)

## 5. Combination of procedures

- ➢ The investigation of the target network is the basis for the future design of the network
- ➢ The risk analysis forms the basis for the renewal of the future network
- ➢ The speed with which the renewal of the network and the network adjustment actually occur to provide destination NET and risk analysis



Example: Development oft he future gas sales until 2025

## 6. Approach of a future target network

A comprehensive, detailed, technically based approach includes:

- o Network: Technical condition, age structure and failure development
- o Market: current and future sales situation
- o Environment: topography, traffic and building structure

- ➢ Step 1: create a network model based on the GIS, operation and consumption data
- ➢ Step 2: design of the future target network with:
    - o Definition of sales scenarios
    - o Optimal sizing of conductors and equipment (regulator stations)
    - o Optimal use of pipeline faults and plant locations
    - o Taking into account the security of supply (incident management)
- ➢ Step 3: implementation of the target network in the context of risk and condition-based replacement renewal of networks
- ➢ Optimization procedures:
    - o Consideration of the sales scenarios to 2050
    - o Minimized capital requirements and network costs
    - o Comperative rehabilitation costs
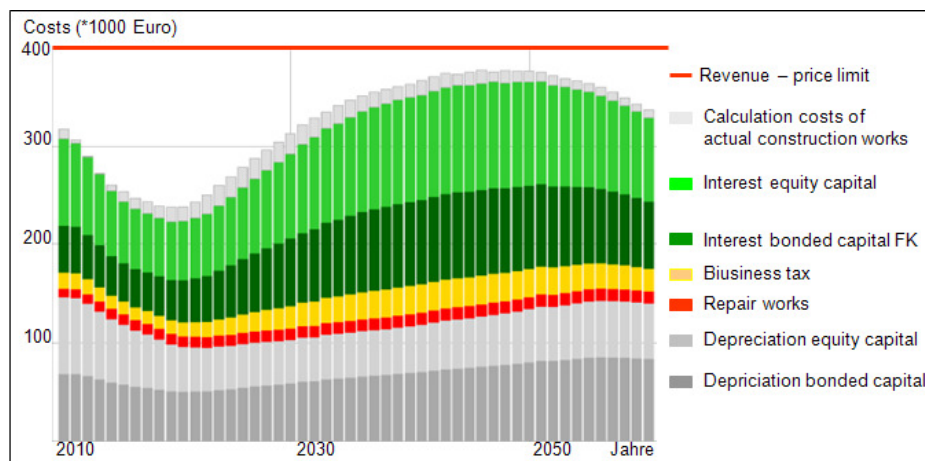


Temporal development of CAPEX for uniform enable and depreciation

## 7. Result

A modelling network analysis is used to answer many questions in the regulatory context, as well as in asset management. Modelling accuracy in principle limited by the high level of abstraction of target networks is not a problem or useful in the sense of a focus on the essential – in many cases.

## Cost optimization of energy networks
## current requirements

- When are to be replace the pipes and pressure control plant?
- What development on failure rates must be expected?
- What risk to supply consists in the pipes and plants?
- What efficiency and redundancy has on the existing network?
- Which optimisation potential can used on a network?
- Can new construction and renovation effectively dimension?
- How many control plants and regulation stations are operationally required?
- Is the use of gas storage required and economically?
- How to develope the regulatory costs of the gas network?
- Can real networks implemented in cost-optimized target networks?

## Cost optimization of energy networks
## on consideration of the network quality
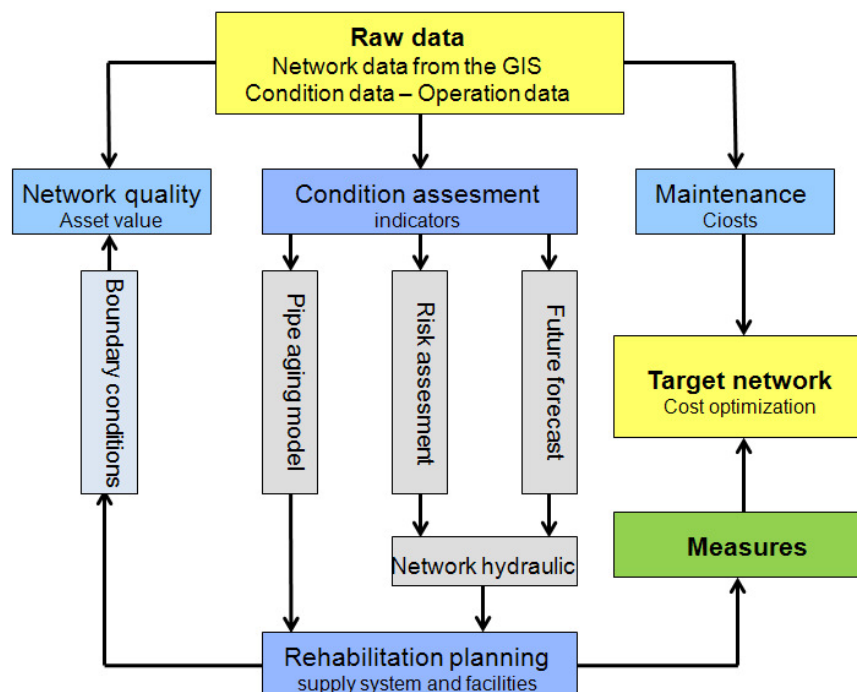
## Cost optimization of energy networks
## analysis solutions

**Pipe network analysis** with temperature-dependent GAS load profiles

From the GIS data of network, a computing network corresponding to the real network is created by interface transfer. The required customer data with consumption, reporting point ID and load profiles are taken directly from the consumption billing. Automation interfaces to GIS and the consumption billing makes sure that the network calculation always presents the same network situation. The network calculation serves as network analysis as a basis for further investigations, as

- Network- und plant- planing
- Determination of resources or defizites of the network
- Analysis of scenariuos for pick load, expansion planing and accidents

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## Cost optimization of energy networks
## Network calculation with a modern pipe section structure
## (Statement of supply- and transport function for each pipe section)
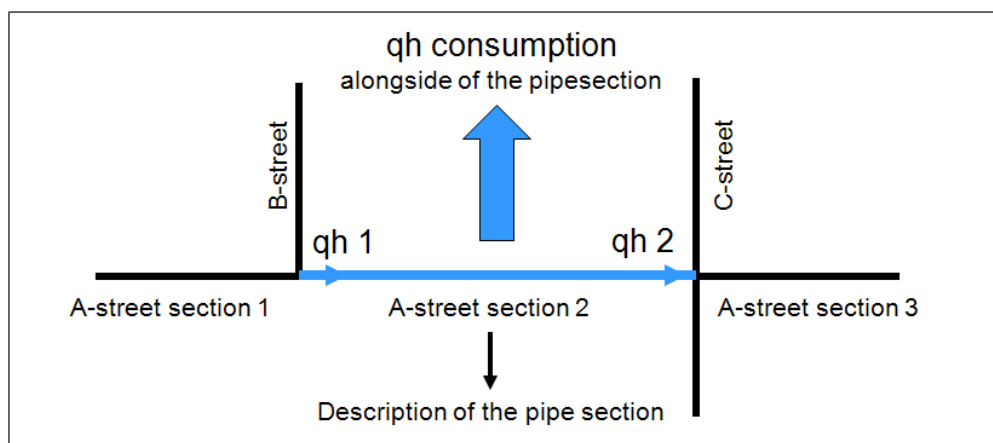


- The annual consumption is allocated to the real pipe sections
- Each pipe section be the inflow (qh 1) and the outflow (qh-2) and expelled the sum of the consumption (qh consumption)

## Cost optimization of energy networks
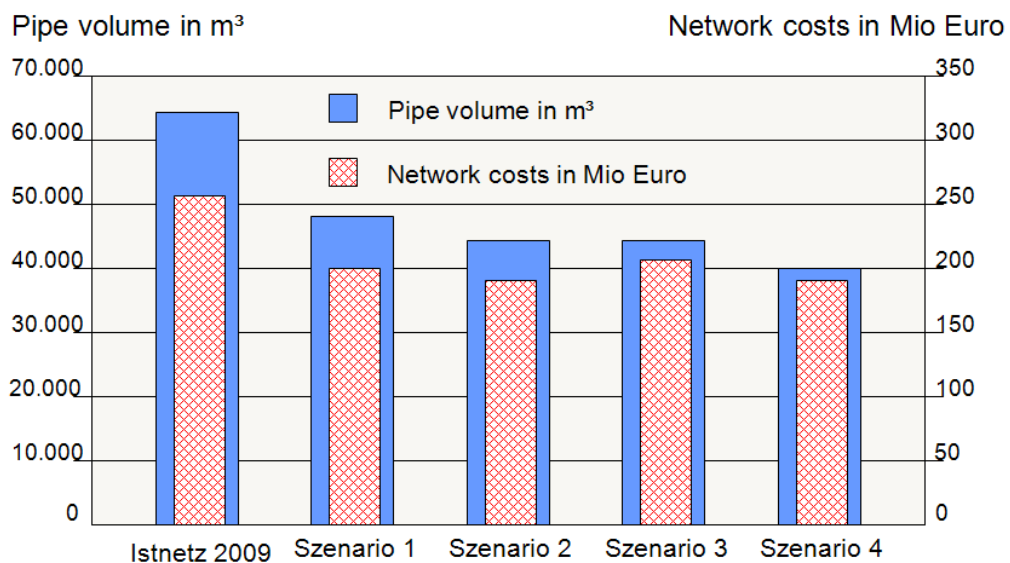## Calculation of a target network

**Pipe network calculation** with optimizer tool to calculate a target network

By the computer optimizer tool the existing network will calculated for a viable target network. The optimal dimensions of the pipes of the network are determined for different sales scenarios or market strategies. It checks the existing topology, the number of regulator plants and the inflow points and inflow quantities under consideration of the security conditions and the respective reserve capacities.

**Thus, possible savings potential can be identified and quantified!**

With the gradual renewal of gas networks, the solutions of the target network planning can be considered. A comparison of the costs of different variants of rehabilitation systems exhibit the temporal development of feasible savings potential.

## Cost optimization of energy networks
## Practical results of a target network analyse
## Presentation of network costs in correlation of the pipe volume



Pipe volume in m³       Network costs in Mio Euro

Legend:
- Pipe volume in m³
- Network costs in Mio Euro

Categories: Istnetz 2009, Szenario 1, Szenario 2, Szenario 3, Szenario 4

# Cost optimization of energy networks
## Preservation of the network quality

**Strategic renewal planning** for preservation of the network quality

With the strategic renewal planning for a existing supply network on basis the age- and loss-sensitive default functions of the pipes determines for a given pipe network based on the current and future development of damage behavior and the resulting monetary damage risk. Through representation of risk potential and the operational impact in case of damages, the risk of each individual pipe section can be calculated. A too high or a too low budget for network renewal activities is to its long-term effects to the evolution of risk examined and evaluated.

Further results of the renewal planning:

- Show the result of the failure- and risk- development
- Show the result of the necessary budget for preservation of the network quality
- Presentation of the effect of a too low budget for the network quality

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# Cost optimization of energy networks
## Average age-Rest service time-Asset value
## Preservation of the network quality by pipe replacement
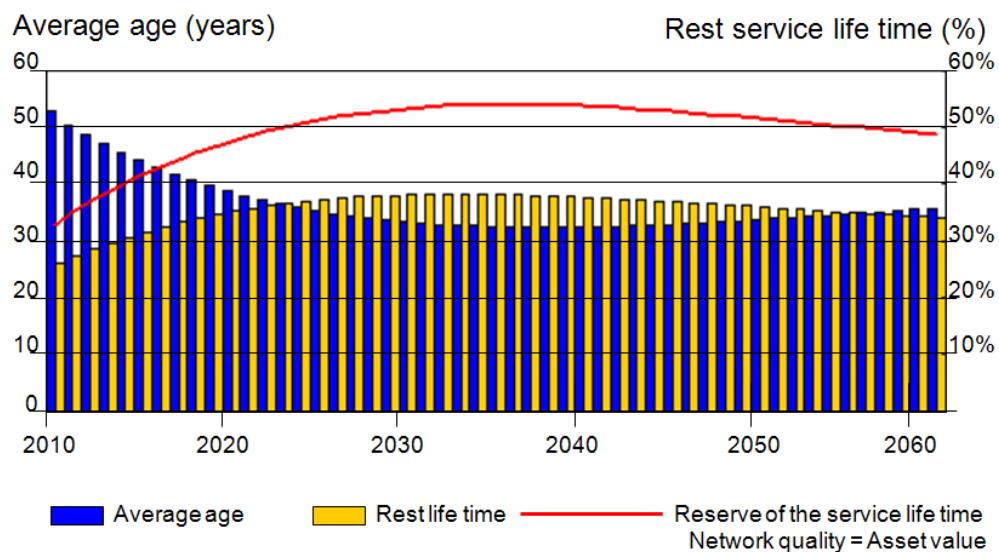
# Cost optimization of energy networks
## Migration tool from the existing network to the target network

**Migration tool** from the ecisting network to the target network

The way from the existing network to the target network is the migration
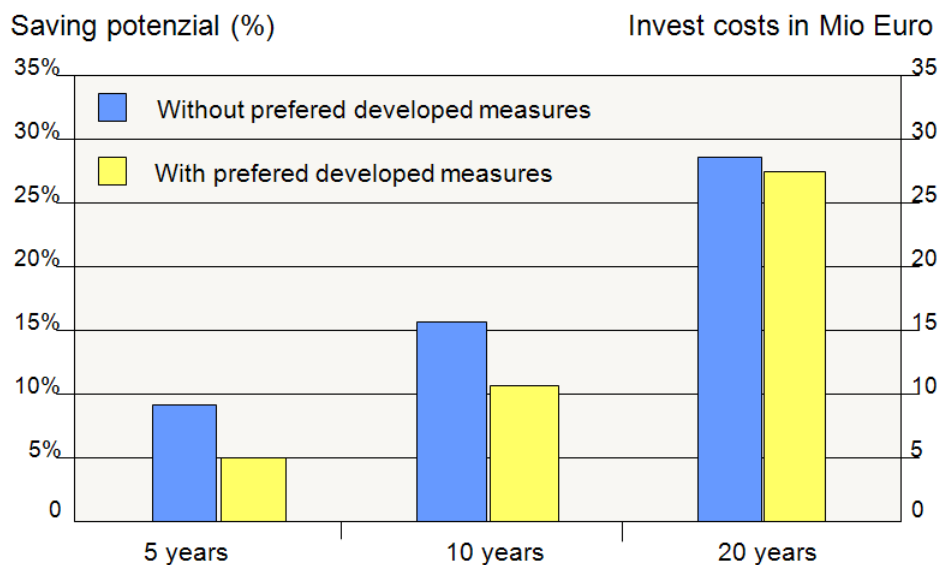
for periods of 10, 20 or 30 years:

- Renewal recommendations of according to strategic renewal planning
- Renewal according to operational planning and development measures
- Renewal of the construction work caused by parallel suppliers
- Renewals by operational requirements and restrictions

The possible saving for the network operator arises on the reduction in the target

network planning:

- of the pipe- and plant- assets
- of the constructed pipe volumes

Each planned individual measures of the future network is to focus on the results

of the target network discovery and risk-oriented renewal planning.

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# Cost optimization of energy networks
## Migration from the existing network to the future network
## Saving potenzial on the way to the target network in different periods

Saving potenzial (%)                                    Invest costs in Mio Euro



- Without prefered developed measures
- With prefered developed measures

5 years    10 years    20 years

## Cost optimization of energy networks
## Determination of priorities for pipe replacement

**Determination of priorities** on basis the risk and the yearly budget

The featured processes and steps require appropriate justifications for their realization.

For gas the supply the minimization of risks and avoiding of damages to the population

and the sorrounding area has top priorities.

It is therefore necessary to work out the priorities of the renewal of pipes responsibly and

to propose according to the given conditions. The specified steps will documented in a

priority list for renewal of supply pipes and service pipes. Basis for these are the failure data

and the risk factors that are set for each pipe or each supply district.

With this methodology, the network operator has the option, the time of renewal with the

limited existing resources to achieve the maximum effect on security of supply and

network quality.

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## Cost optimization of energy networks
## Determination of priorities for pipe replacement
## Results of the rewenal planning visualized in the GIS
## influenced by different external criteries and acuteness



Rewenal planning – Evaluation of acuteness and priorities of pipe replacement
Pict. 1: short term replacement          Pict. 2: medium term replacement

## Cost optimization of energy networks
## Consulting - Service – Software orientated solutions

**Implementation** of the solutions of the existing network to the target network

The gas supply systems are today forced network charge approval and incentive regulation to strive for a minimum of cost and a maximum of efficiency for the pipeline systems.

The pressure of the regulatory development of cost and optimization provides the current network structures in question in conjunction with demographic change in the coverage areas, as well as the energy savings regulation. For gas networks there exists a saving-potential which is today put the planning technology is as a rule.

hammerer-system-messtechnik offers professional engineering consultancy, services and software based solutions on the basis of the existing GIS data to solve the described problems. The tasks can be individually evaluated and implemented recognized and experienced partners.

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## Cost optimization of energy networks
## Consulting - Service - Software orientated solution
## Migration tool for implementation
## from the existing network to the target network