FICHTNER

From Expert Tools to the Digital Grid

A German Asset Management Journey starting in the 1970s

Institute of Asset Management
iAM
CORPORATE MEMBER

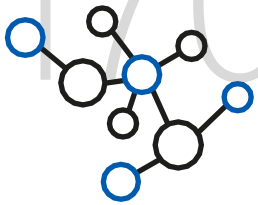
Agenda

- Introducing Fichtner
- The 1970s: How it all started
- The 21st Century: Assessing utility grid networks
- Today: Optimal decisions based on shared information
- Contact

1922

Established in 1922 and family-owned ever since

170



Project experience in more than 170 countries

246

Total turnover of €246 million in 2017

1500

More than 1500 employees worldwide – over 130 of these in Ireland & the UK

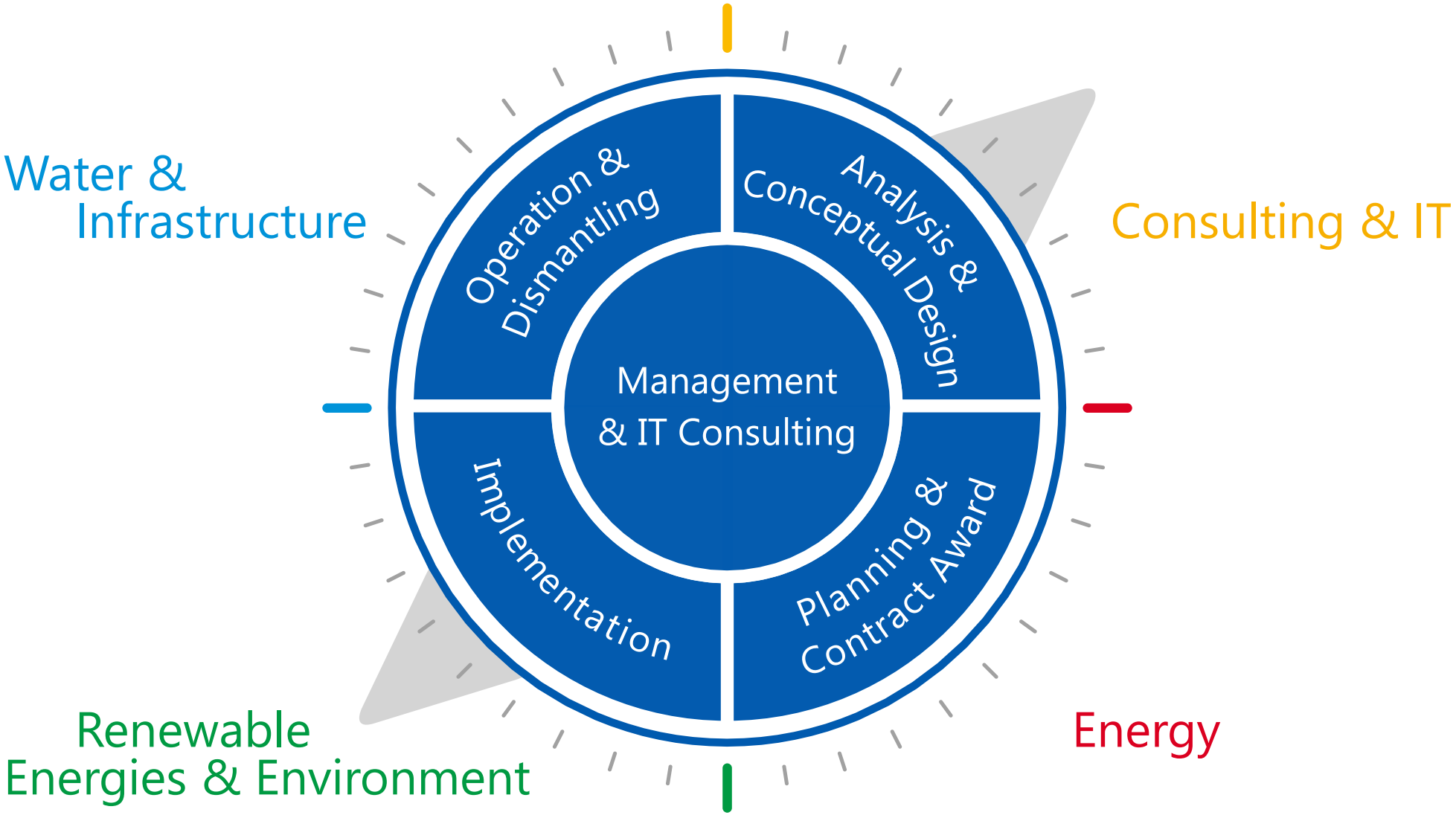
2

Established in the UK in 1991 opening 2 offices in Ireland in 2018

ISO

ISO Certified systems for Health & Safety, Quality, & Environmental

Home office in Stuttgart | 22 subsidiaries and affiliates
Over 100 branch and project offices | Present in 60 countries worldwide



Planning and consulting in all project phases -
for technically and economically sound solutions

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The 1970s

How it all started

With many pipes in the distribution networks dating back to pre-war times, the first increase in incidents motivated research into pipe ageing in the 1970s

- The development of the software OPTNET began in 1977 on behalf of the GDR government.
- More than 80,000 km network and 120,000 incidents were evaluated
- First assessments based on lists of pipes without spatial representation

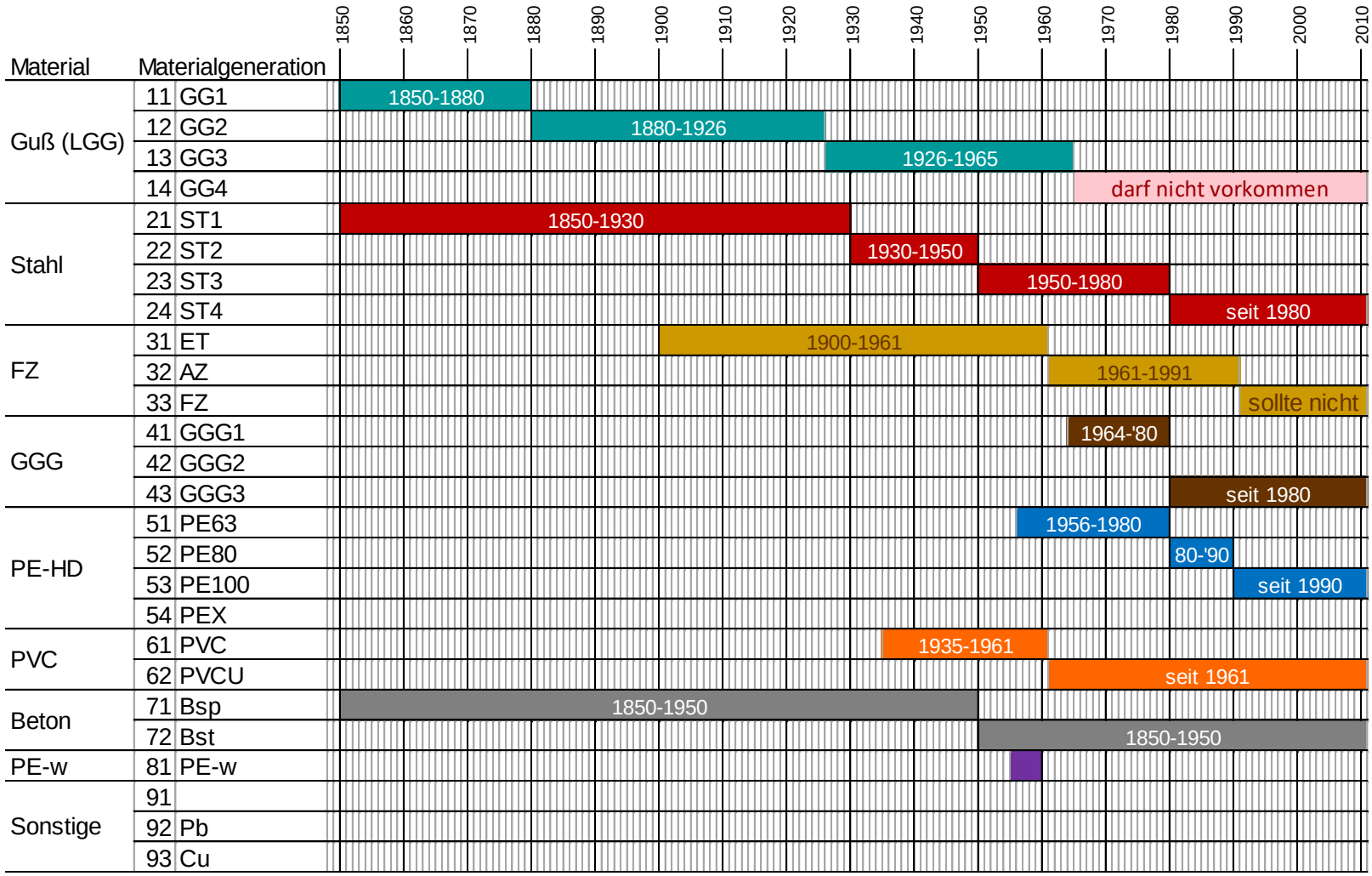
Rohrmaterial	BRD [2]	BRD [2]	BRD [2]	BRD [1]	DDR [3]
	1970	1980	1990	1987	1988
	%	%	%	%	%
Guss	63,8	57,7	53,5	55,0	41,0
Stahl	9,0	6,3	5,1	5,7	21,9
AZ/Beton	9,5	11,5	11,1	11,1	25,3
Kunststoff	17,5	24,0	30,1	28,2	11,8
Sonstige	0,2	0,5	1,2		
Länge	159.600 km	255.800 km	304.300 km	287.000 km	91.000 km

Cast iron
Steel
AC / concrete
PVC/PEHD
other

By Bundesarchiv, B 145 Bild-F031434-0006 / Gathmann, Jens / CC-BY-SA 3.0, CC BY-SA 3.0 de, https://commons.wikimedia.org/w/index.php?curid=5454732

The initial focus was in understanding pipe materials, related incidents and becoming able to forecast incident rates for metallic pipes

Generations of materials used for pipes in Germany based on research by Prof. Roscher :



At the end of the 1990s the DVGW published a set of rules and regulations for condition based rehabilitation of water and gas networks

- In 1998 the DVGW (professional body of water and gas professionals in Germany) published the technical guidance document W 395 starting the collection of Germany-wide statistics on incidents in water networks.
- The figure on the right shows the state of knowledge about incident rates per material at that time.
- In 1997 and 1998 documents W 401 and G 401 were published, offering suggestions on rehabilitating water and gas networks.

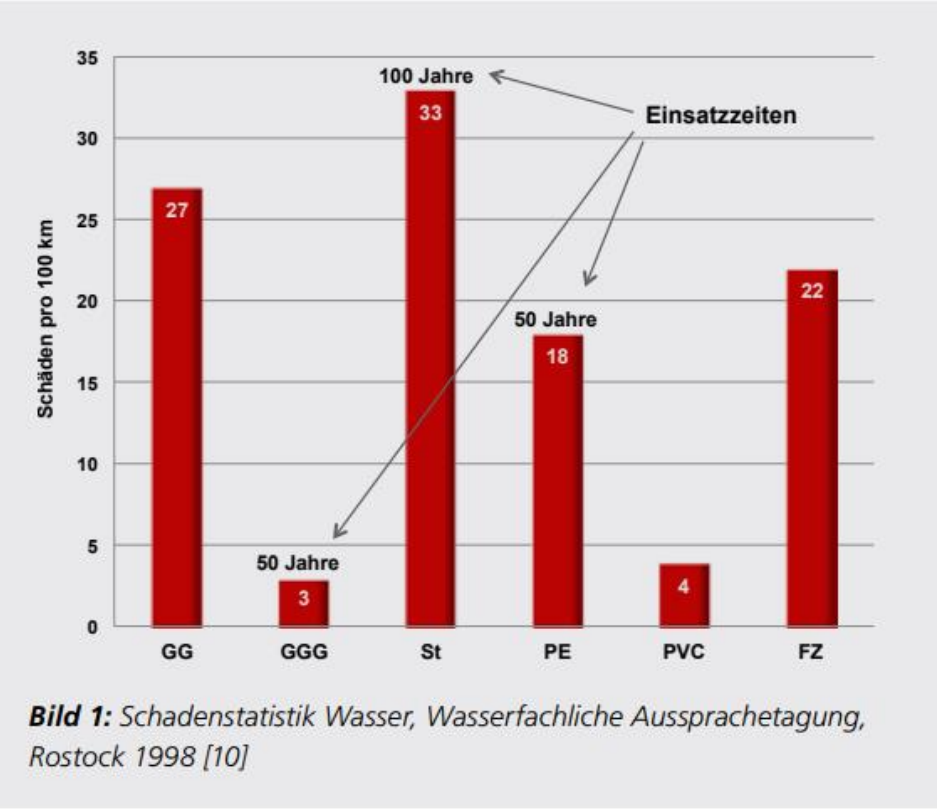
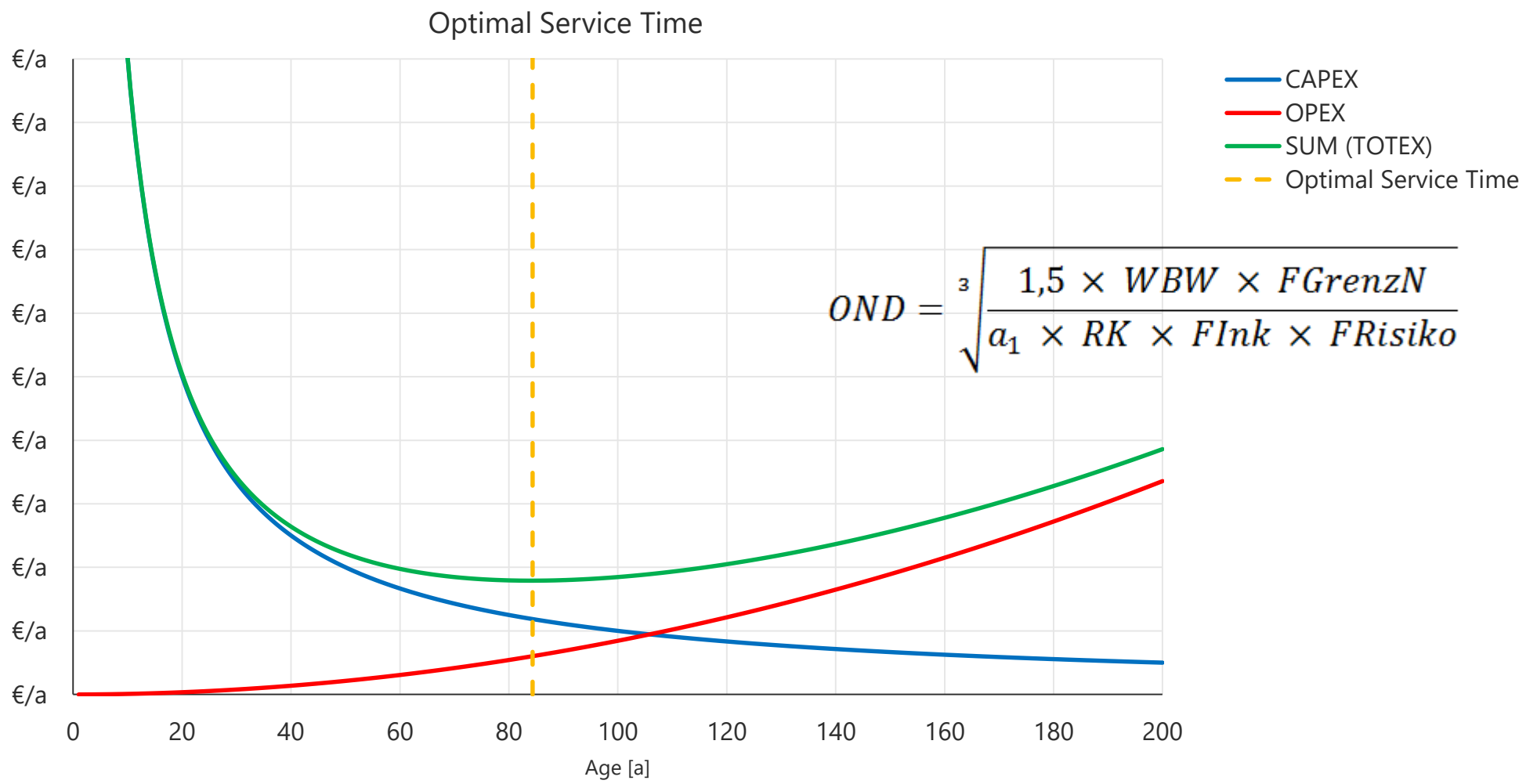


Bild 1: *Schadenstatistik Wasser, Wasserfachliche Aussprachetagung, Rostock 1998 [10]*

Results of incident statistics, 1998

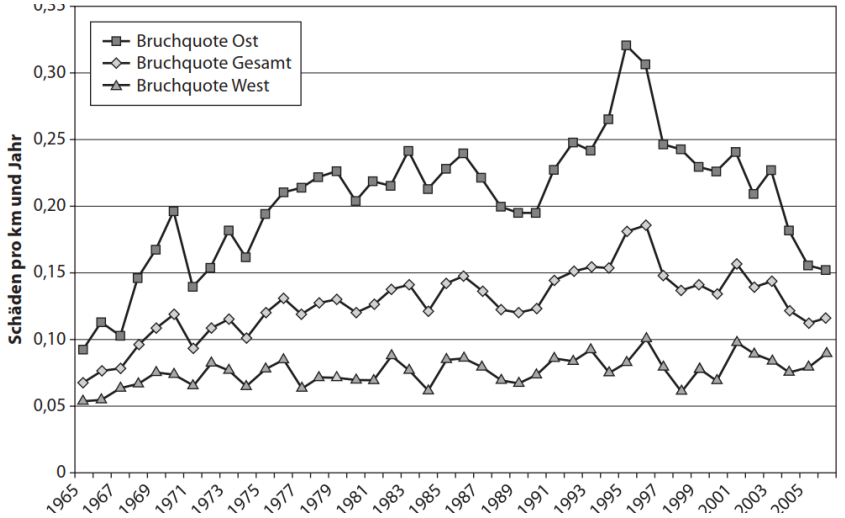
By 1985 OPTNET defined the ‘Optimal Service Time’ as the time when replacement would be more economic than repairs (LCO)

Introduction OptNet-L

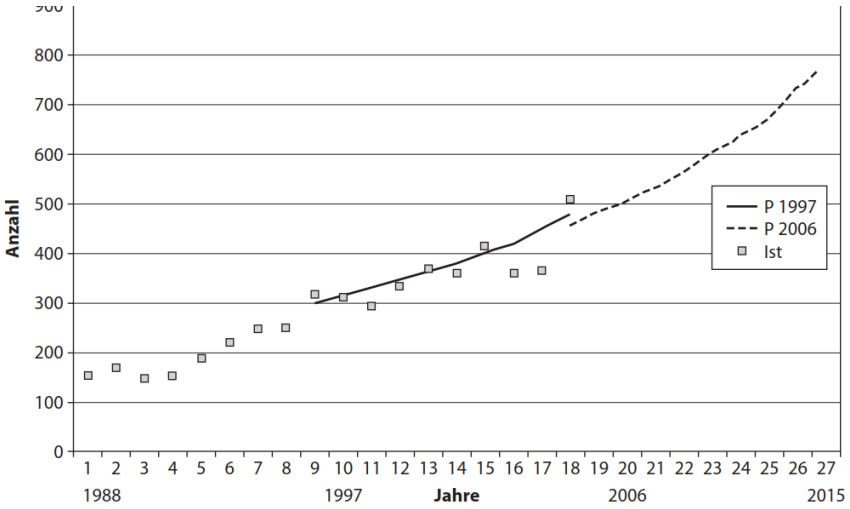


With the division of the Berlin drinking water network in 1964, a large test field was unintentionally created to observe ageing behaviour of pipes.

- With the fall of the wall it became possible to compare the ageing of the water networks in east and west Germany.
- Without rehabilitation strategy the incident rate in East Germany rose by about 700% to a peak value of 0.34 incidents/km/a from 1960 to 1995 the.
- At the same time in West Berlin, due to strategic rehabilitation the incident rate only rose by 30-40%, to 0.07 – 0.09 i/km/a.
- Rehabilitation thus enabled West Berlin to avoid 11,500 incidents between 1965-1995!
- The review of the 1997 model results by OPTNET in 2007 showed that the forecast for a 10-year period differed by less than 4%.



Comparison incident rates east and west Berlin



Comparison Forecast 1997 and 2007

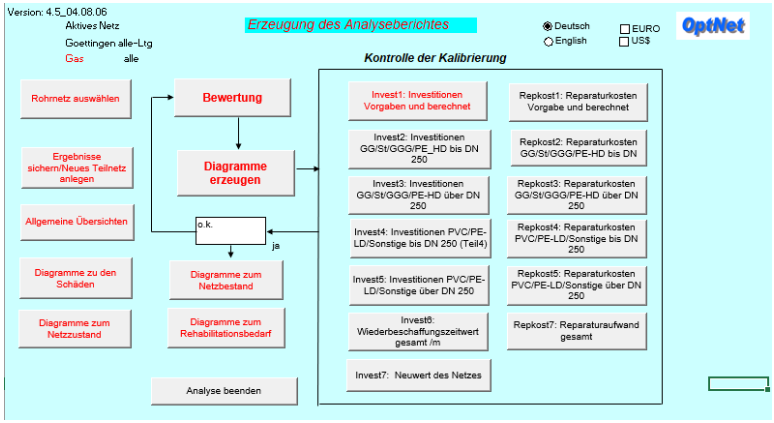
Modelling of the ageing-function proved possible with a minimum of data, though allowed for refining the results by additional information

$$S(T) = (a_0 + (a_1' * f_1 * f_2 * \ldots * f_n * T^2)) * l$$

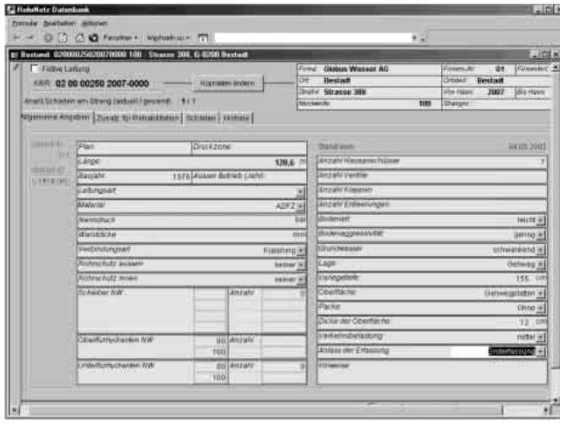
	Network elements	Defects / incidents
necessary	Material, Age, Diameter, Length	Number, Year, affected pipe and/or coordinates
Good to have	Nominal pressure, wall thickness, number of valves, hydrants and house fittings, type of corrosion protection, pavement, location within street and traffic load, earth movements, cathodic corrosion protection	Type and cause of damage, mode of repair
If available	Pipe joints, depth, aggressivity of ground water, type of soil, hydraulic data (pressure and flow), previous repairs	Stray currents, condition of pipe wall and corrosion protection, distance to others

By 2009, when Fichtner took over, OPTNET had become a powerful expert tool constrained by a UI that would deter all but the most regular of users

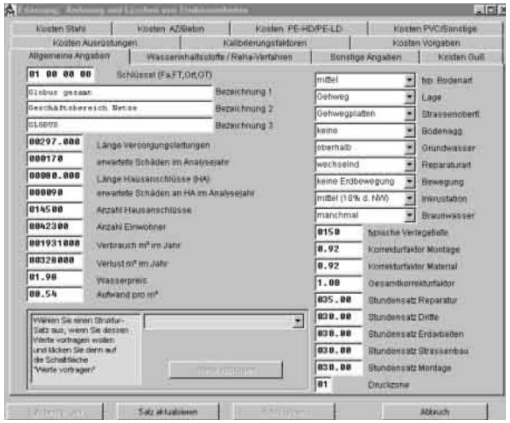
- The actual modelling had been completely re-written in C++ starting in 2001
- To update models based on GIS exports and for those clients without GIS an MS Access tool was supplied
- Modelling results would be analysed using an MS Excel file with 200+ diagrams
- For import/export and spatial representation STANET (then Germany's leading tool for calculating network hydraulics) was used.



UI Analysis in Excel



UI MS Access Tool



UI modelling tool

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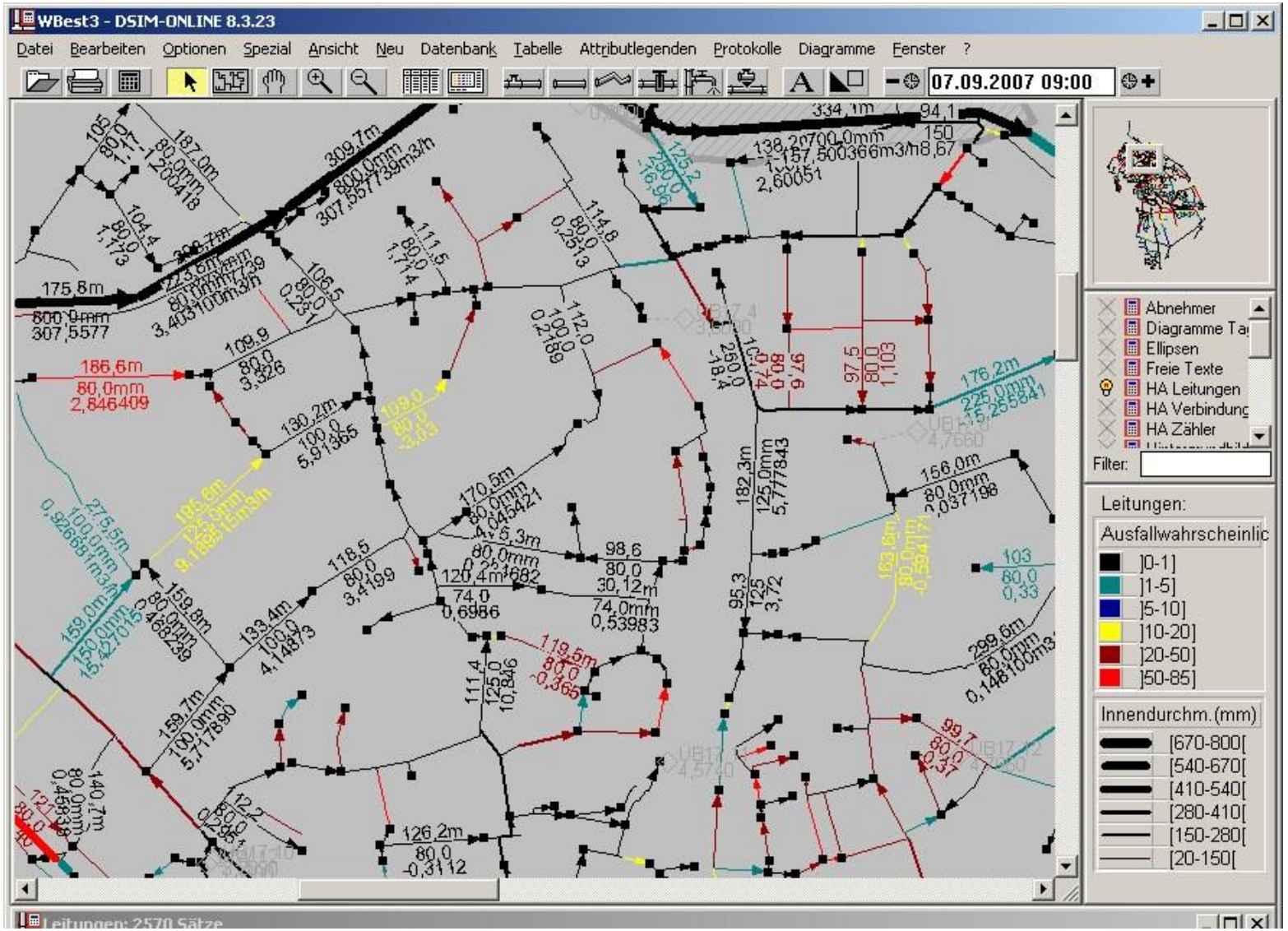
The 21st Century

Assessing utility grid networks

Working closely with STANET gave a UI known to expert users and allowed to easily include hydraulic results.

Display of failure probability in STANET:



Results of the health assessment could be analysed in spatial contents

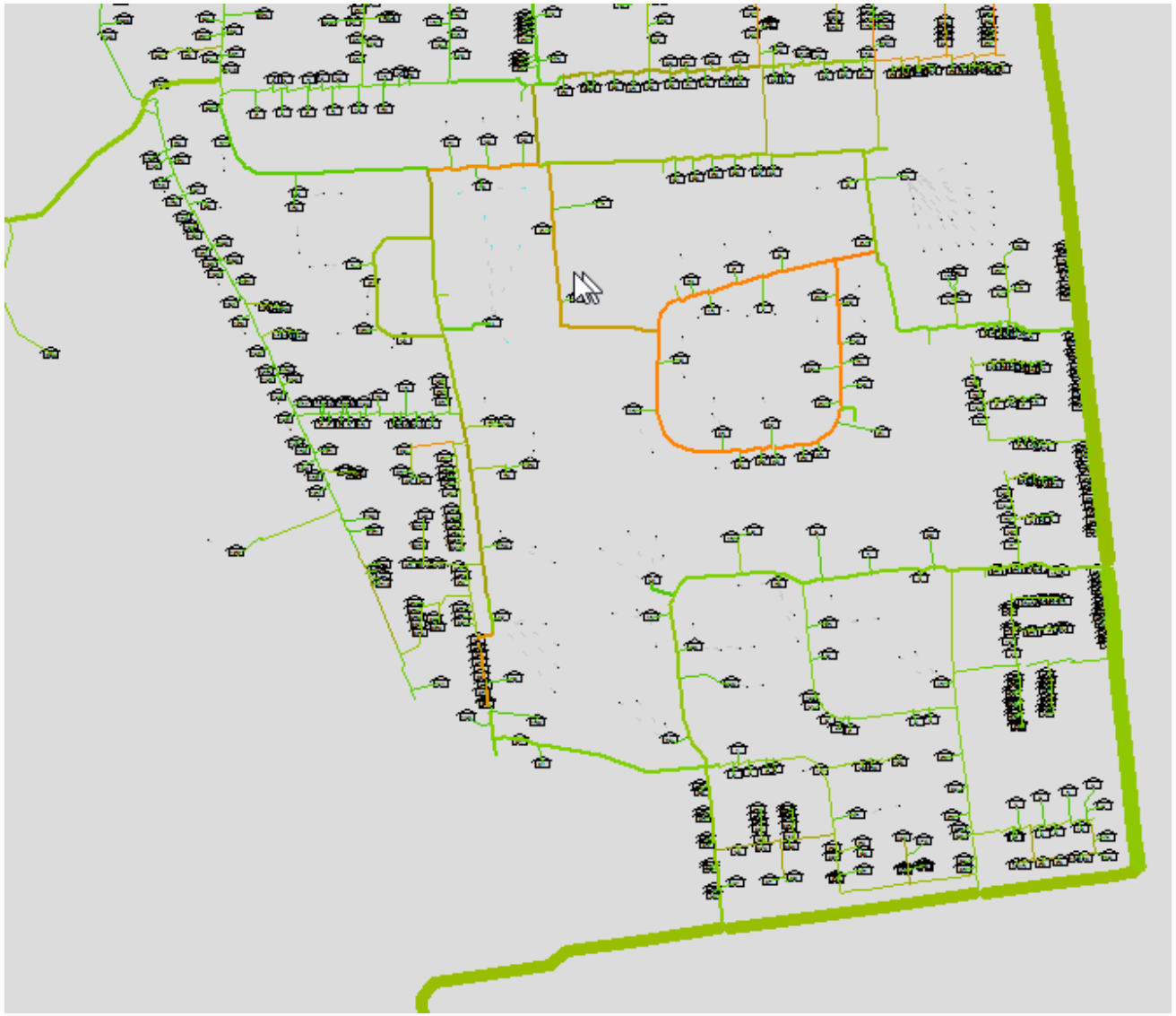
Result of health assessment (green: good, red: high failure probability)

N-1 calculations allow for assessing impact on supply guarantee. They tend to identify few high-impact lines while showing no results for others

Result of n-1 analysis (green: no clients without supply, red: high impact on supply guarantee)

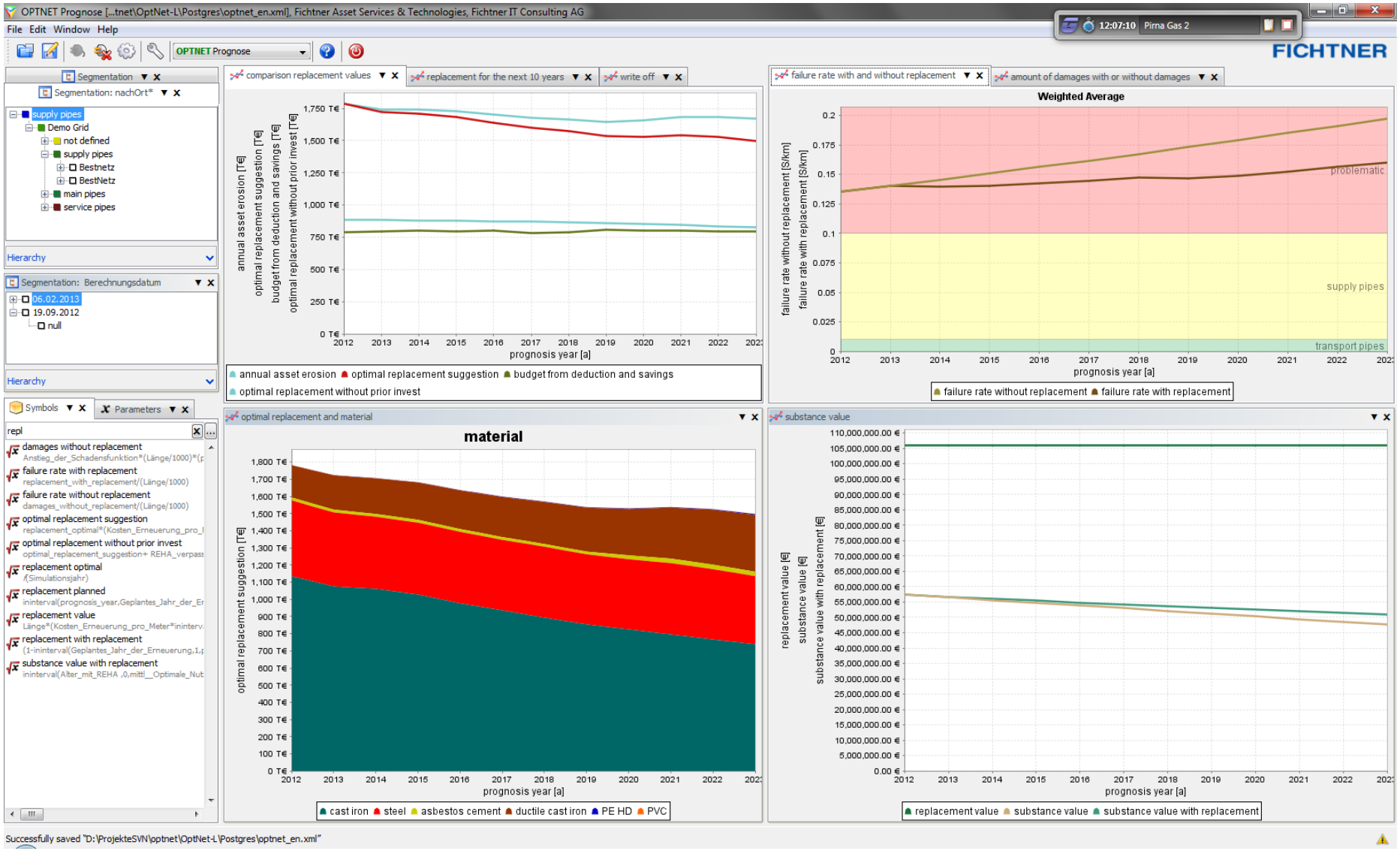
Combining health and criticality a risk model is created that can be used to prioritize measures

Result of risk assessment (green: low risk, red: high risk)



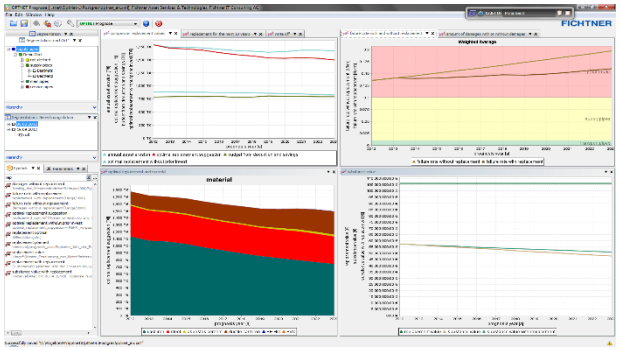
Integrating OPTNET with a state of the art EAM tool in 2011 allowed for professional data analysis and handover of aggregated data to strategic AM

Analysing results in OptNet-L

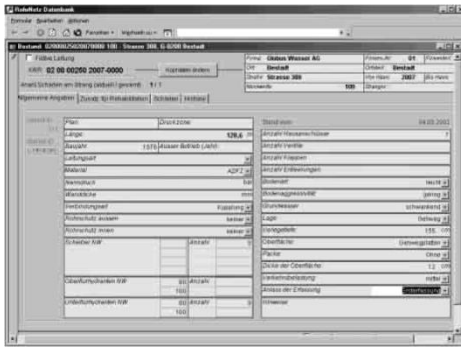


Even though the software would allow other departments to access results, silos were still standing…

- Results would be used within the investment planning process
- Proposed measures would be imported to GIS for further planning
- Assignment of book values would need to be done manually
- Impact of regulation would typically be assessed by specialised departments



UI Analysis in OPTNET L



UI MS Access Tool

UI modelling tool

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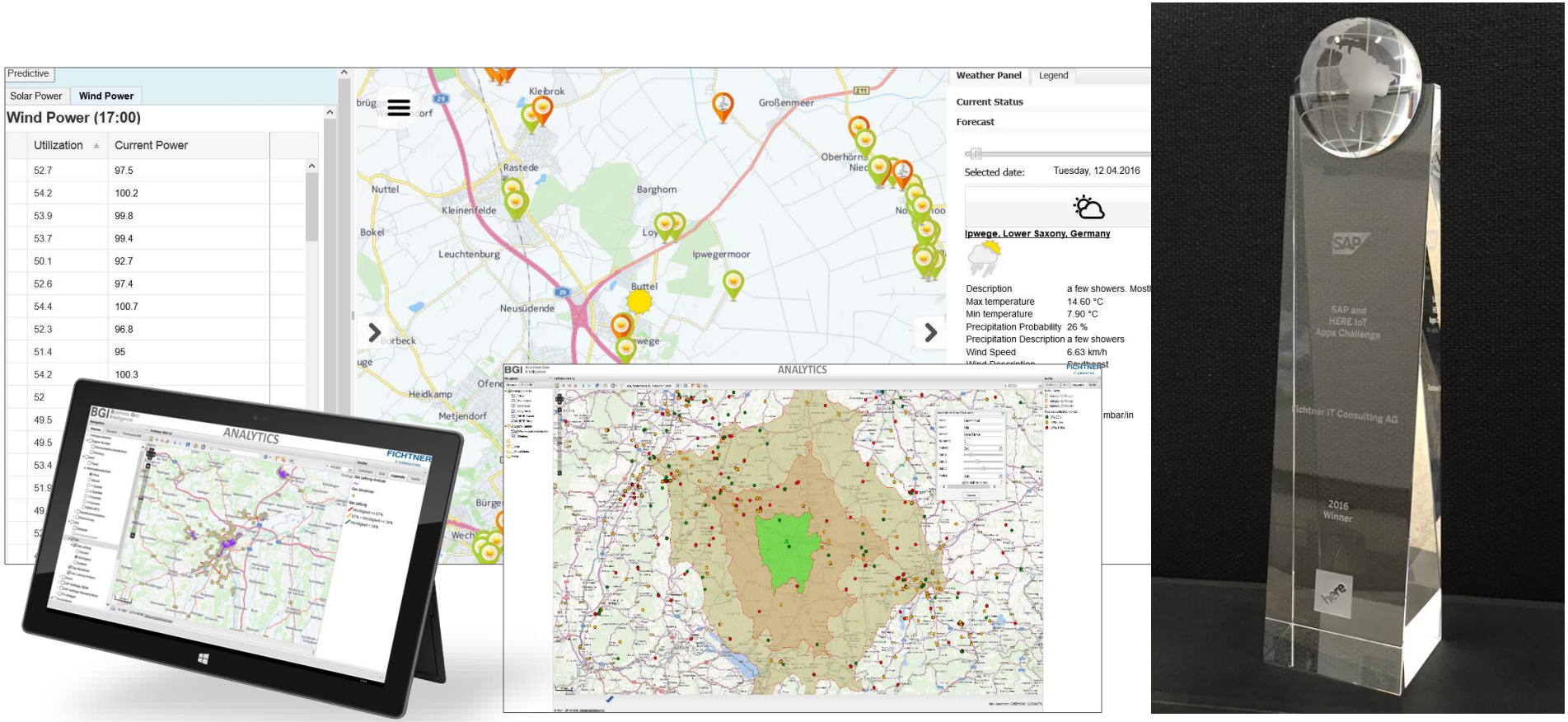
TODAY

Optimal decisions based on shared information

Fichtner BGI (Business Geo Intelligence) is a well established tool for enabling decision making in a spatial context

By combining asset data with operational data and weather info BGI won the international SAP and HERE IoT Apps Challenge 2016.

Innovative IoT App

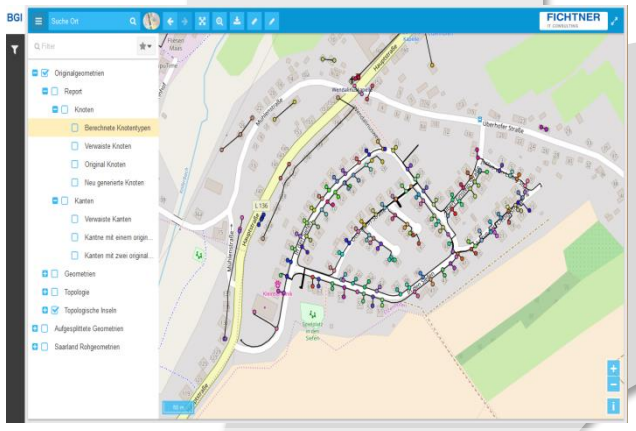


App Video at:
https://onedrive.live.com/?authkey=%21AJJfP5nKwy4%5FvjQ&cid=46F781387C28A909&id=46F781387C28A909%2118450&parId=46F781387C28A909%2118431&o=OneUp

Source: FIT, SAP AG

FICHTNER Digital Grid combines BGI with powerful modules for smart integration and expert tools to provide a solution that can be used across departments.

BGI Grid Analytics



FICHTNER Digital Grid

Expert Tools

- BGI Calculate
- BGI Control
- BGI Optnet
- BGI Maintain
- BGI Policy
- BGI Document

Engineering Services

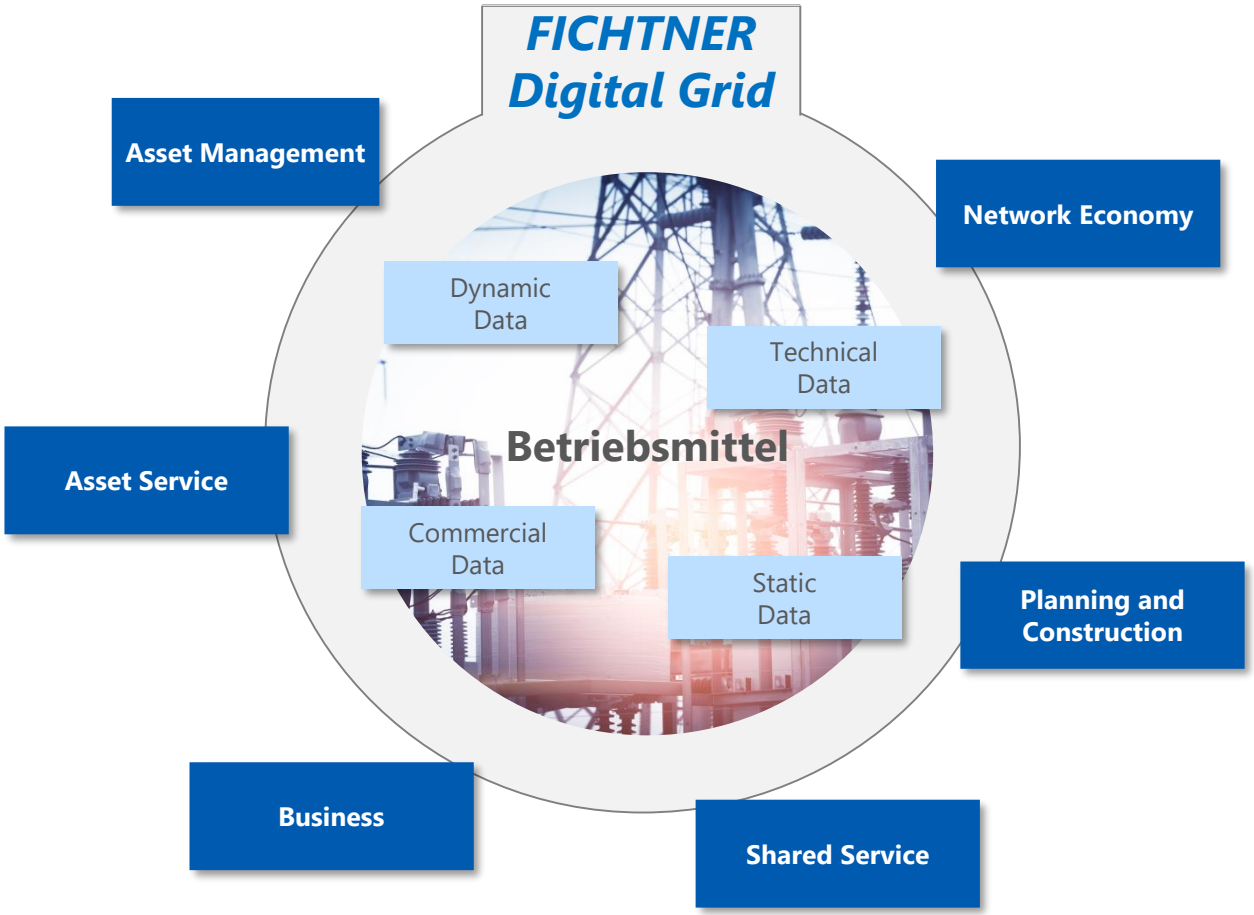
- Network Analysis
- Governance Management
- Operative AM
- Enterprise Asset Management
- Strategic AM
- Grid Documentation

Smart Integration

- BGI Import
- BGI Connect
- BGI Enhancement
- BGI TopoManager
- BGI CheckBack

Integrated network analysis
Calculation algorithms

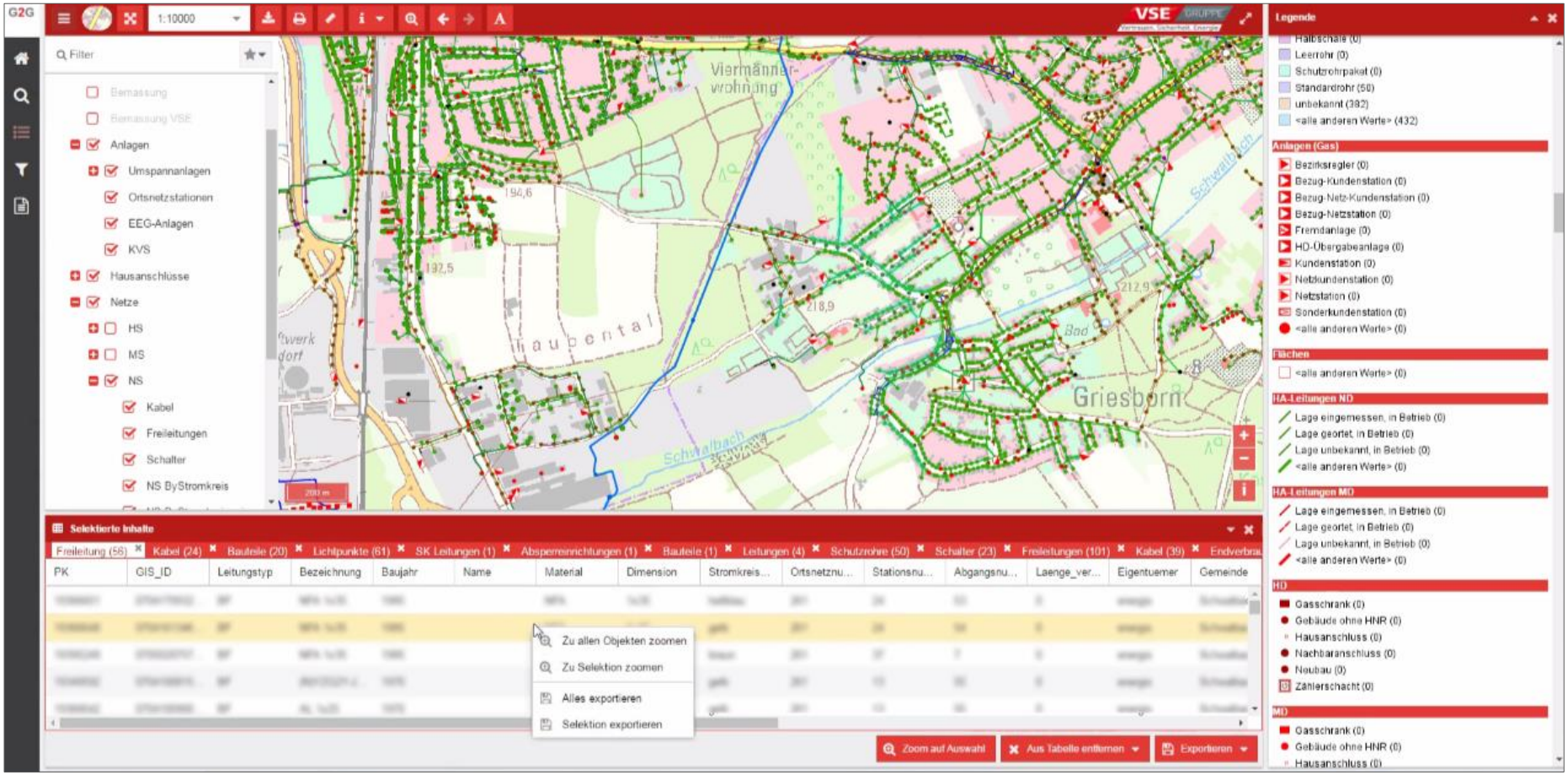
Breaking open old silos FDG offers a synchronised, cross-process, asset-based view by combining information previously locked up in expert tools.



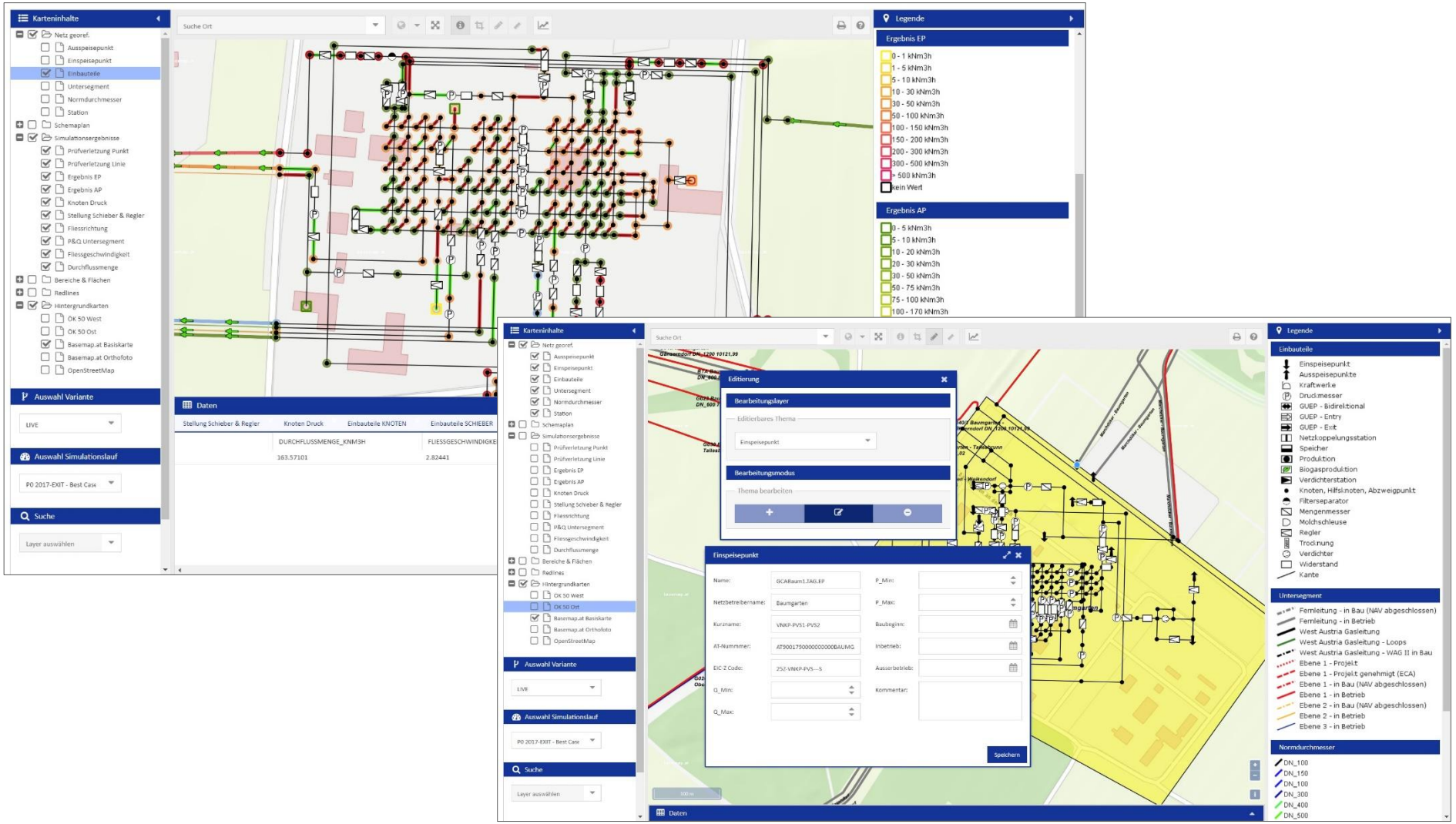
Typical Questions

- What loads are caused by the currently approved new PV systems on a sunny day?
- In what condition is a facility and are there plans for third-party construction in the area?
- What kind of failures did we have in the concession area last year and what were the causes?
- Which property situations need to be taken into account when replanning?
- …

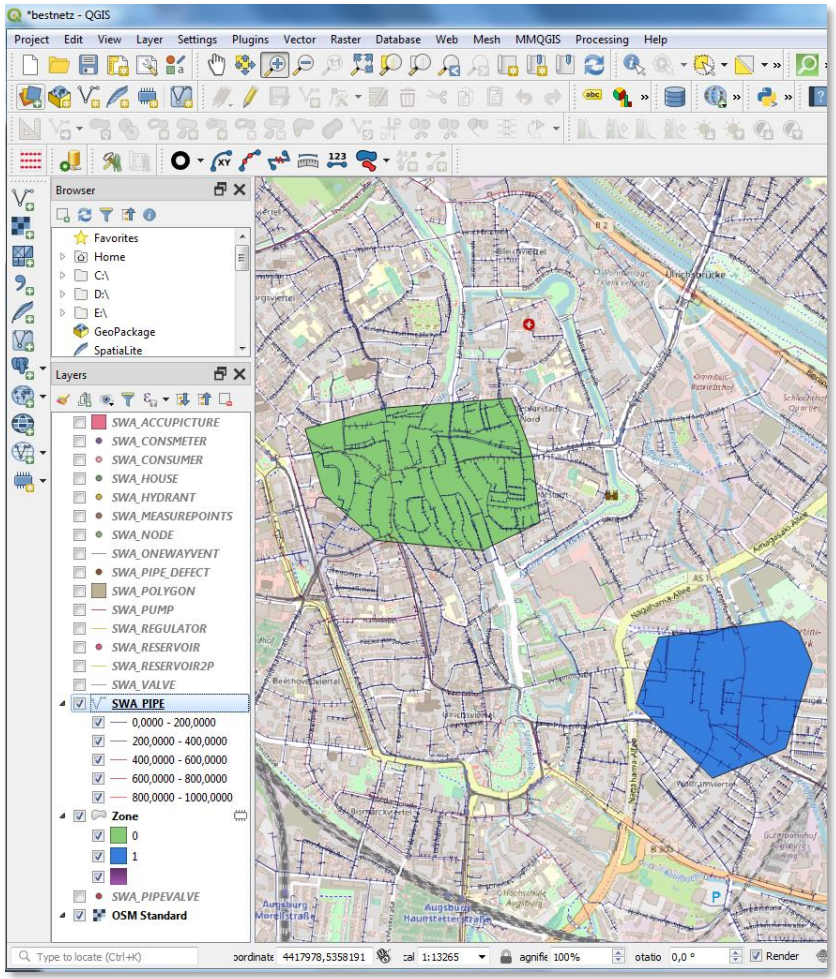
Creating a true digital twin by combining data from GIS, ERP and other systems a multitude of different tasks in the company can be simplified.



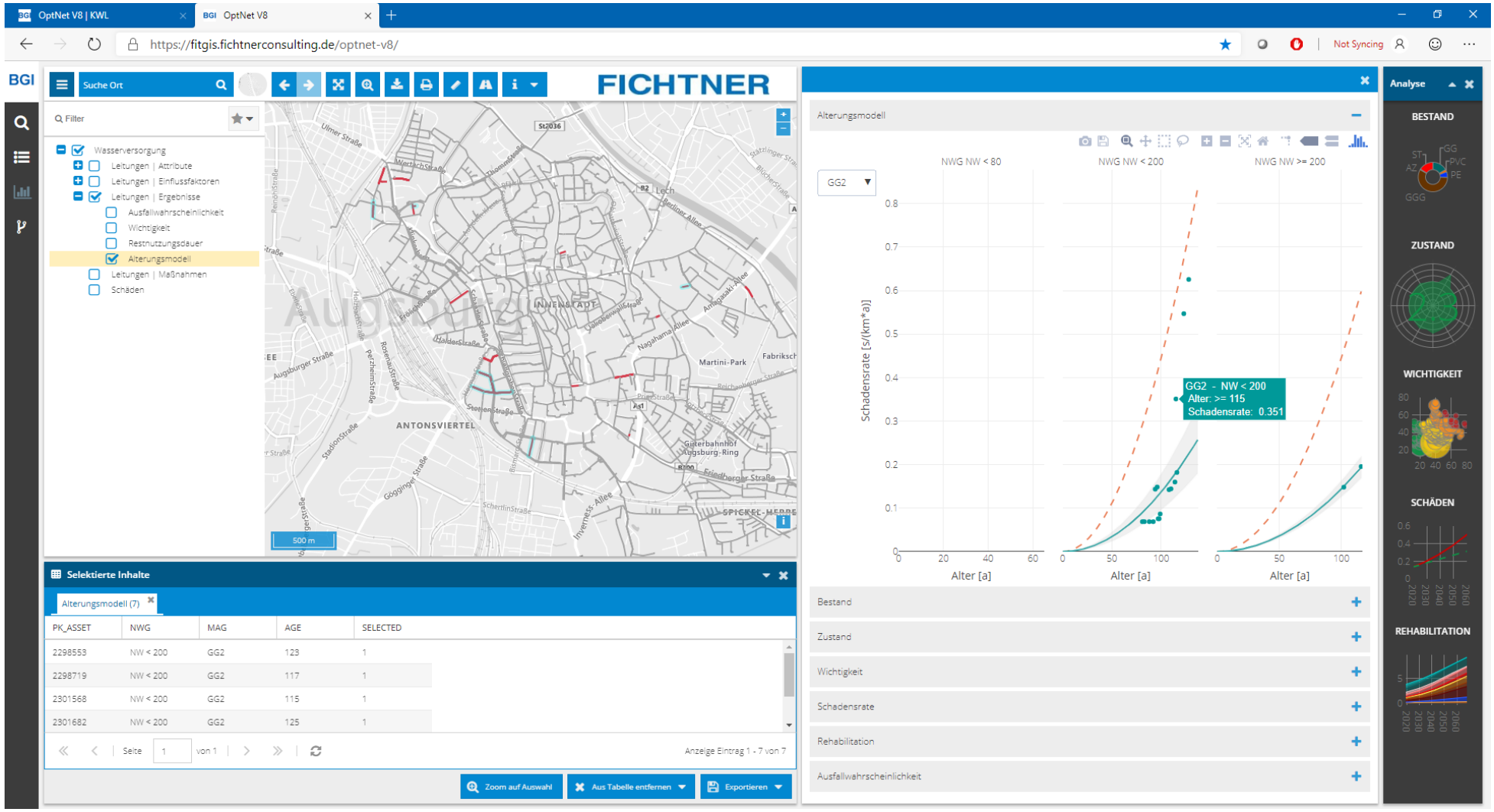
Asset systems can also be represented schematically, allowing the user to seamlessly „zoom in“ on system details



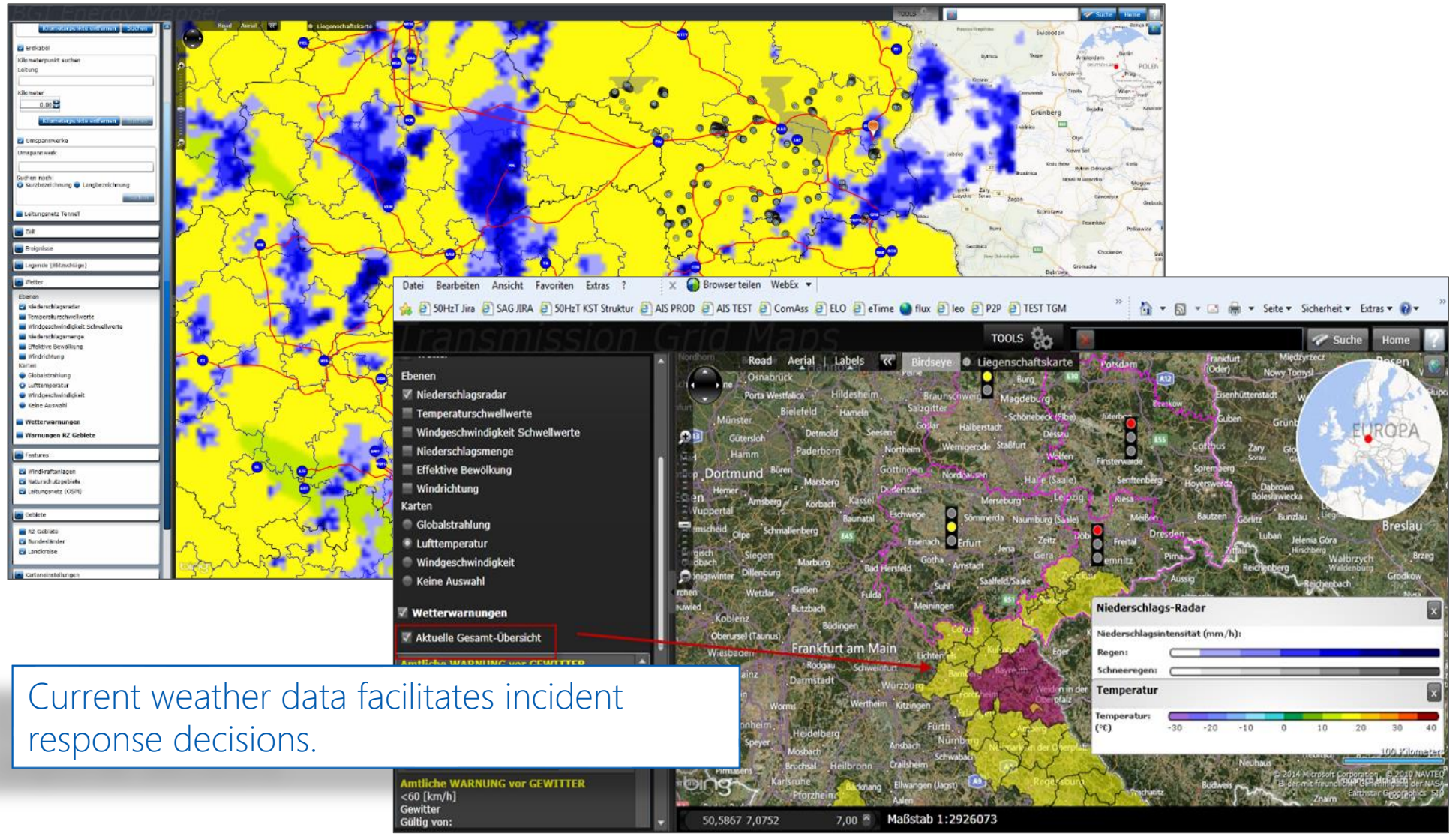
Updating data with spatial information can now be done “live“ on the database, saving duplication of tasks with the GIS department.



Interaction between spatial view and statistical diagrams makes modelling results easier to understand and lowers failure probability.

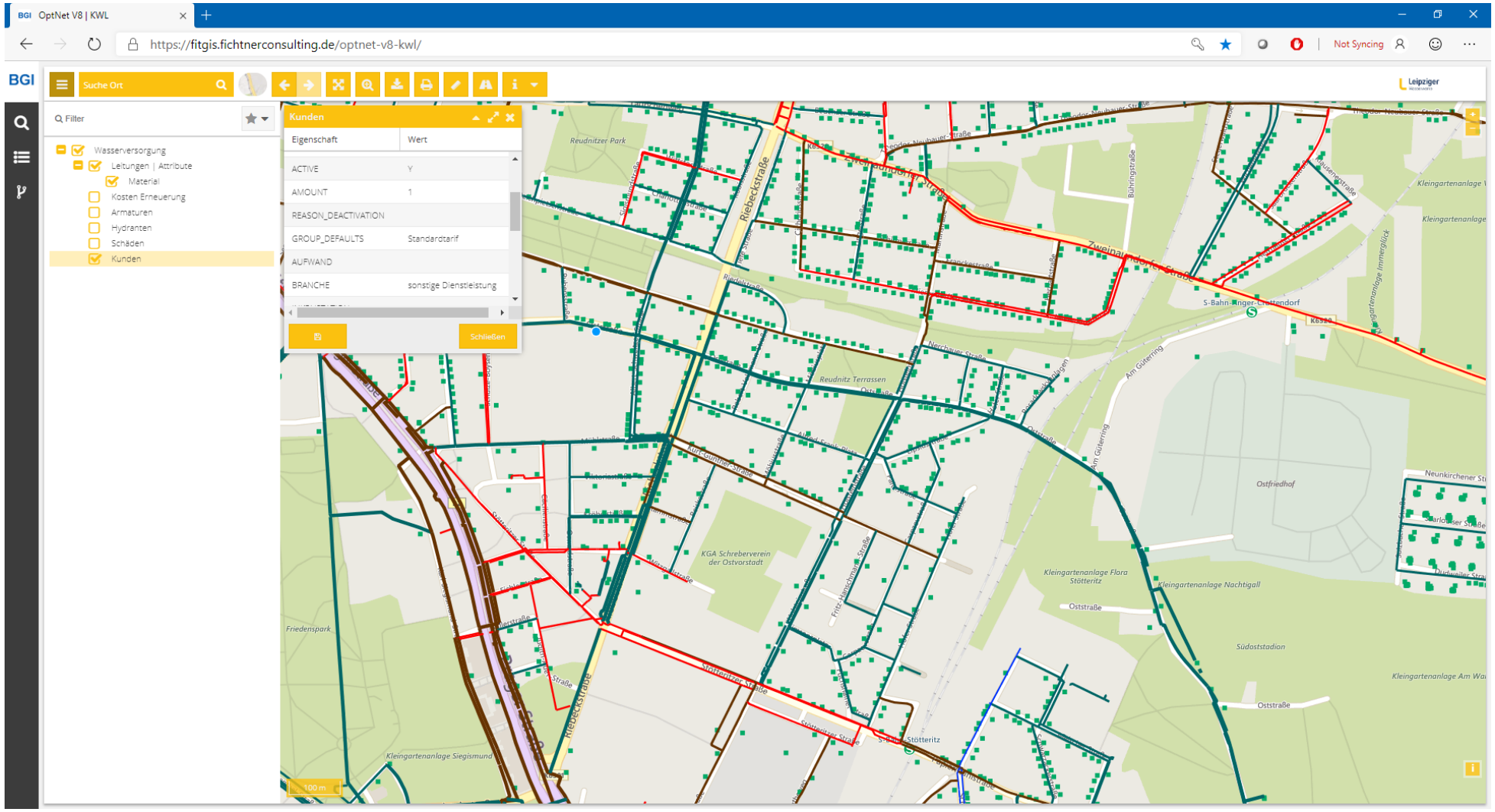


Data from web services (for example weather data) can easily be included.

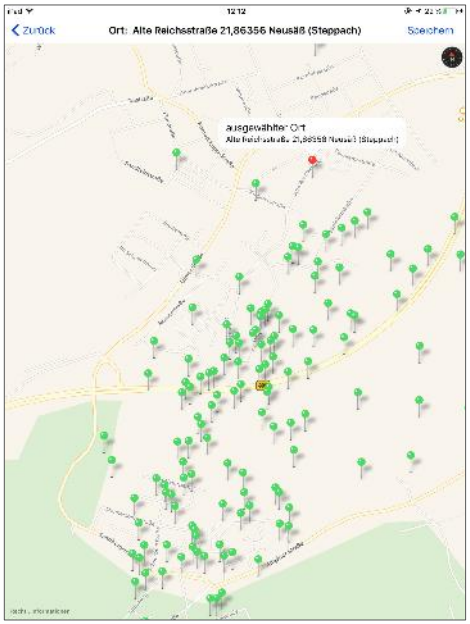


Current weather data facilitates incident response decisions.

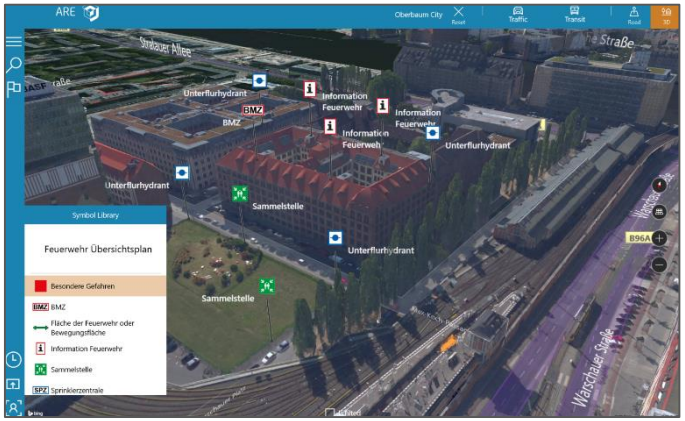
Forecasting outage-duration per client based on the asset health forecast allows for a true understanding of asset risk.



Cross-platform and offline capabilities allow all use-cases to access the same information



First realised projects show interesting possibilities of application of augmented Reality, 3D und Microsoft HoloLens



https://www.facebook.com/BR24/videos/10154367984080336/?hc_ref=PAGES_TIMELINE

Quelle: Fichtner IT Consulting AG. Microsoft Corp., hhpberlin, AGGM

Summary

- The Journey of enabling utilities to ensure good investment decisions started with first research in the 1970ies.
- By 2011 it had become a mature expert tool for assessing asset risk and analyzing results but it became clear that to endorse good Asset Management a platform would be necessary that allows all departements to work together.
- By including OPTNET as a module within Fichtner Digital Grid the results become useable across departments. All asset-related data is accessible within one solution for all tasks.

Fichtner Digital Grid can thus facilitate good decision making by breaking down old Silos!

Thank you for your attention

Your contacts for further information

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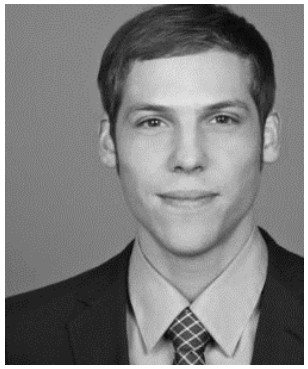

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