

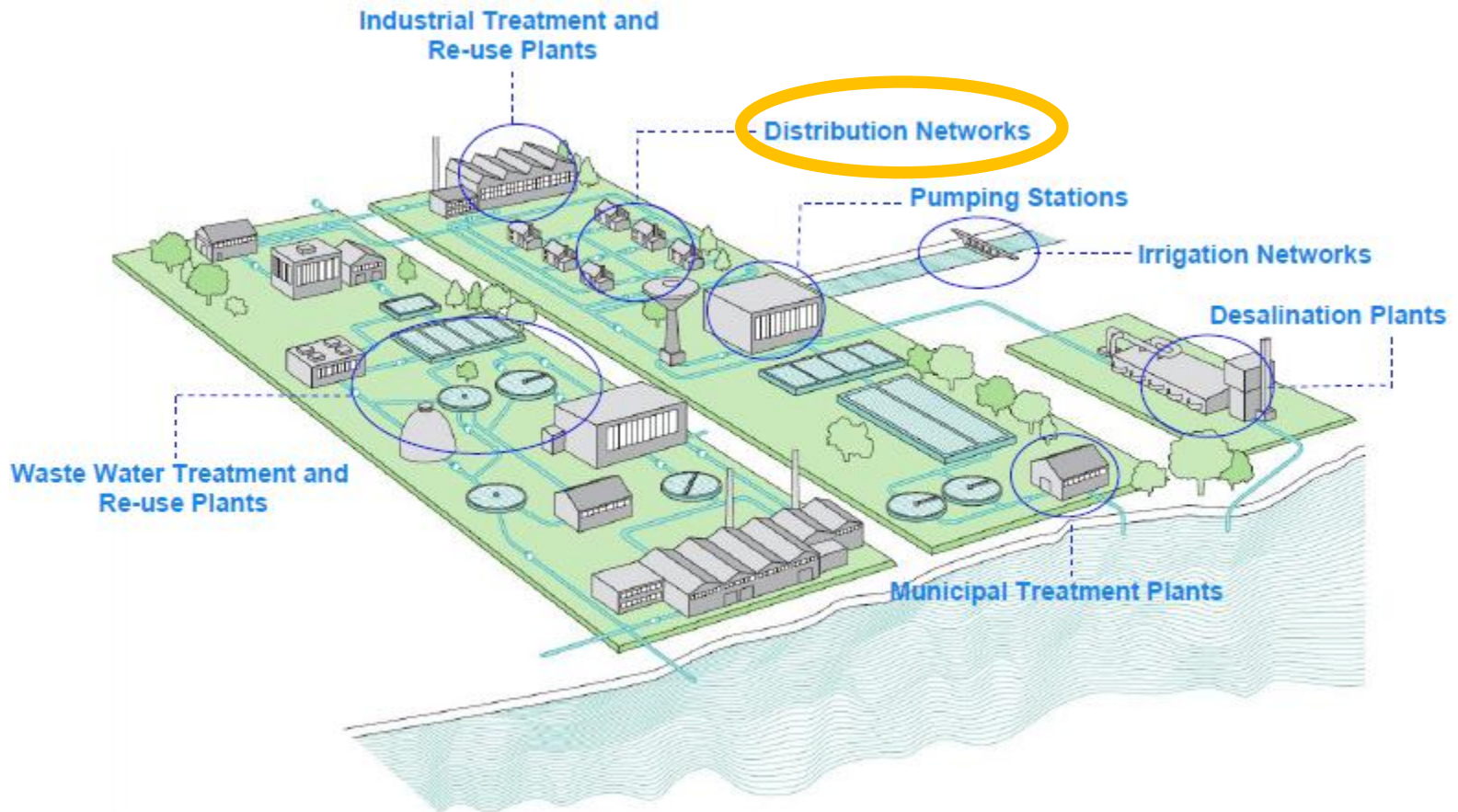
Martin Schreyer, ABB AG - PSP-M11, Nov. 23rd, 2011

MENA Water Leakage Summit

ABB Solutions for Water Distribution

Water Cycle

ABB's Key Application Areas in Water



Water Distribution Systems

ABB System Solutions



- Operation of wide area networks essentially requires accurate measurements, reliable communication as well state-of-the-art control systems
- ABB scope covers complete instrumentation, automation, communication and electrification of entire distribution network as well as turnkey pumping stations
- Operational software solutions to cover address key challenges in network operation
 - Leakage management
 - Pressure management
 - Energy management
- ABB expertise and capabilities in water network management demonstrated in numerous projects globally
- Services for the whole life cycle → strong capabilities due to local presence

Water Distribution Systems

Challenges in today's Water Network Operation

Customer service levels

- Reliable supplies with minimal interruptions
- Supplies with high quality of water

Operational Expenditures

- Efficient use of utility staff
- Water losses minimized down to economic level of leakage
- Minimized specific energy consumption

Sustainable operation

- Minimized environmental impacts based on guidance for operation & maintenance

Operational Expertise

- Keeping operators expertise
- Making better use of available data

Water Distribution Network Operations

Excourse – Main Characteristics of Economic Principle

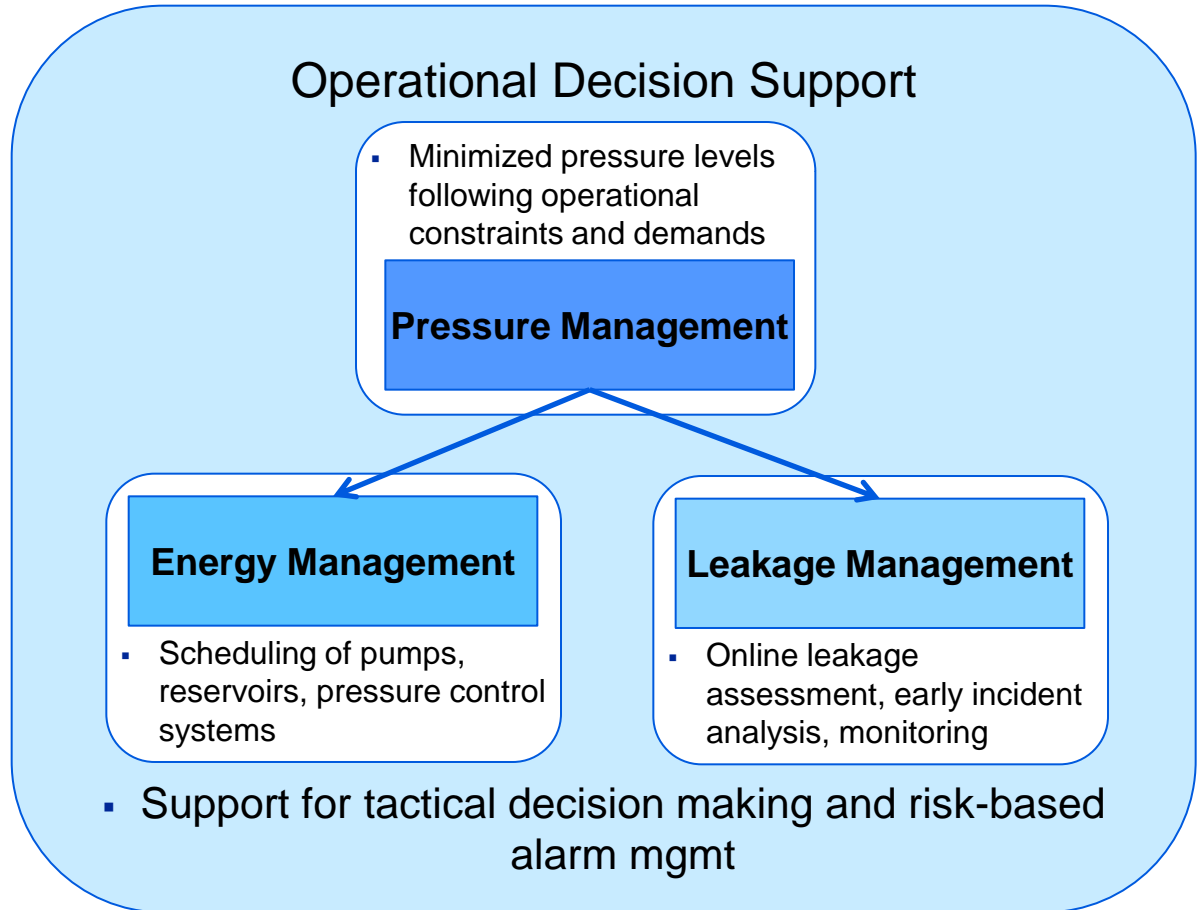
- **Minimum Principle:** achieve target using a minimum of resources
- **Maximum Principle:** use available resources to achieve a maximum output
- **Optimum Principle:** defined optimal relation of deployed resources and intended target by yield optimisation
- E.g. use less energy to achieve objected supplies
- E.g. increase supplies using same level of energy
- Maximize supplies and minimize energy usage so as to the point of maximum financial return

- Key principles guiding investments, operations and maintenance
- Different principles provide for different objectives
- Monitoring and optimization measures key to implement principles

Managing the Challenges

A way forward...

- Integrated operational environment
- Extensive use of online process data, data correlation, signal processing
- Operational decision support using model-based analysis
- Innovative visualization and alarm management
- Early awareness of incidents
- More timely and better decision making
- Context and situation sensitive data and information availability



The Window to Operations

Integrated Geographical Information System (GIS)

Objective

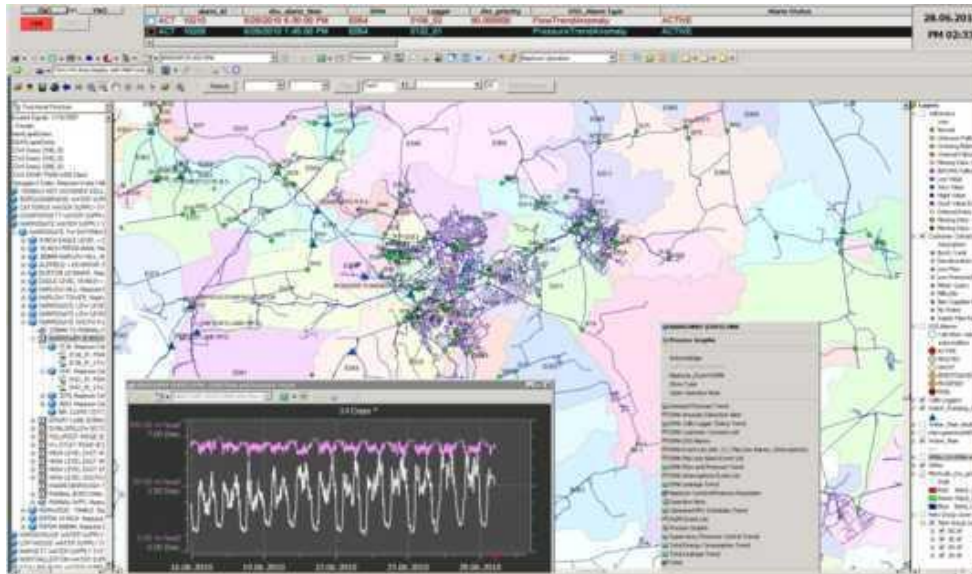
- Combined representation of temporal and spatial data
- Support more timely decision making

Rationale

- Linkage of temporale data to geography: intuitive navigation and information access

Benefits

- Situation and context sensitive information access, e.g. alarms, objects
- Control system context menu available in GIS → direct information access
- Cross navigation: reduced time to look out for required data
- Configuration flexibility using layer structure in GIS



Leakage Management

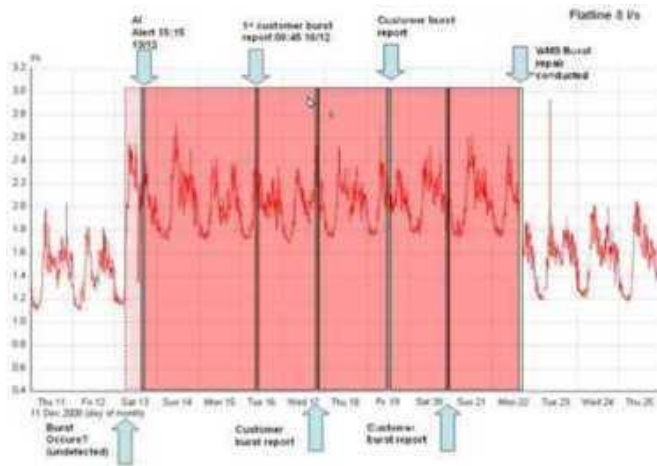
Signal based Anomaly Analysis

Objective

- Early detection of emerging

Rationale

- Raise operator awareness for system incidents at earliest possible point in time
- Minimize customer supply impacts



How?

- Leakage-like patterns analysis using signal data (Neuro-Fuzzy algorithm)
- Automated online analysis of raw sensor data (flow, pressure)
- Raises notice following 12 hours analysis
- Regular self training

Benefits

- Automatic leakage size estimation
- Automatic incident identification: additional margin to execute operational measures
- Improved supply quality, reduced number of customer supply interruptions
- Minimized operational expenditures
- From reactive to predictive operation and maintenance
- Does not require a network model

Decision Support System Incident Analysis

Objective

- Analysis of identified anomalies, automatic assessment and visualization
- Ranking of incidents following incident root analysis
- Intuitive visualization using impact assessment results

Rationale

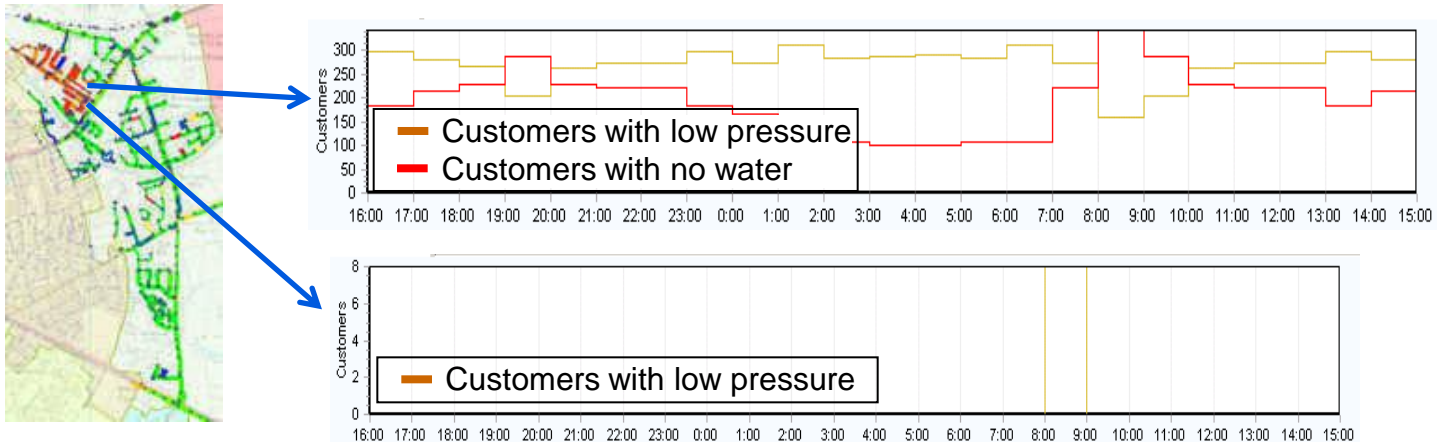
- Generate understanding of incident impact, expected number of customers impacted get most severe incidents and location of incidents
- Intervention strategy proposal

How?

- Fusion of hydraulic simulation data, measurement data, available information like customer contacts, pipe burst model data, likelihood calculations

Benefits

- Automatic incident impact evaluation and assessment
- Incident localization down to pipe level
- Online operator guidance
- Automatic intervention strategy proposal
- More effective and efficient use of resources



Decision Support System

Alarm Analysis and Statistics

Objective

- Automatic generation of alarm analysis and statistics
- Reporting

Rationale

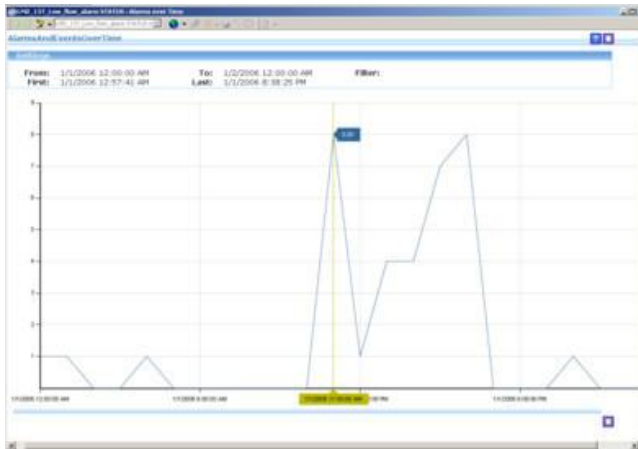
- Make better use of available data
- Support decision making process
- Enhance operational knowledge

How?

- Statistical analysis of alarms based on data and events in information system
- Graphical visualization/reporting of alarms over time such as
 - List of „top 10“ alarms
 - Distribution of alarms per priority
- Follows EEMUA 191 guideline

Benefits

- Better use of available data
- Automatic report generation
- Support for decision making process
- Operational knowledge build up



Pressure Management

Supervisory Pressure Control (SPC)

Objective

- Minimizes pressure levels in related control zones
- Chooses optimal set-point schedules (24h time horizon) for all pressure set points in highly nonlinear network operation

Rationale

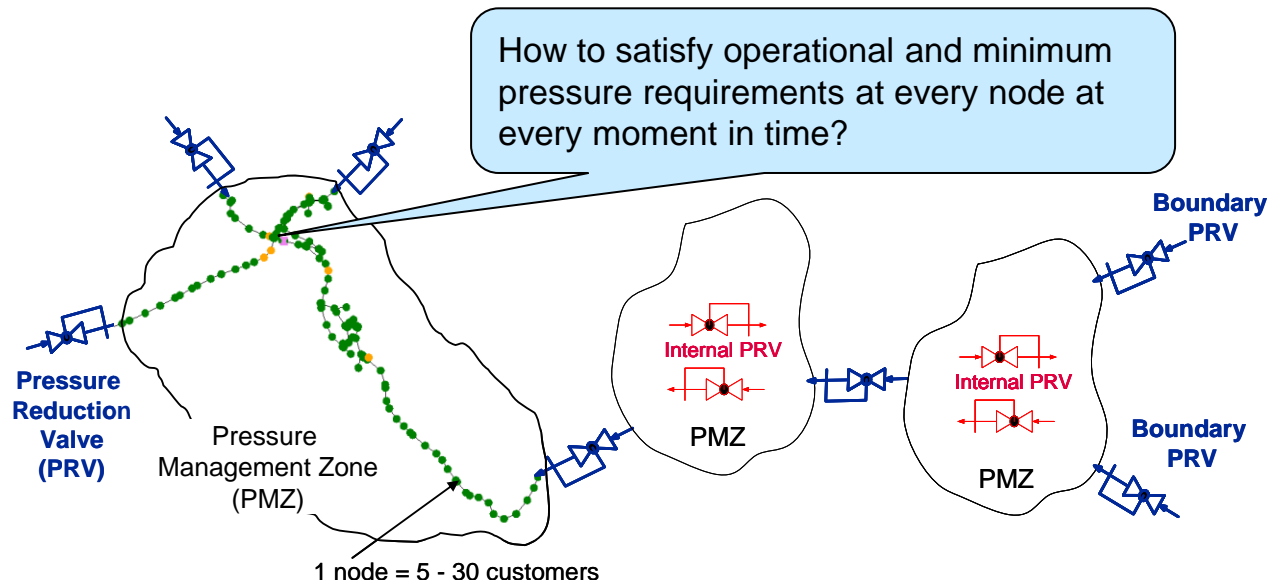
- Reduces energy and leakage costs
- Optimal response in case of abnormality

How?

- Hydraulic model based calculation of optimal valve set-points

Benefits

- Pressure set-points adjusted online according to demand
- Online calculation of time or flow modulated set-point schedules for PRVs
- Set-points remotely or locally adapted
- Minimized pressure level: reduced energy consumption, reduced leakages



Energy Management Scheduling for Water Network Operation

Objective

- Online calculation of set-point schedules for pumps, reservoir/tank levels, water source withdrawals
- Recalculation in case of abnormalities

Rationale

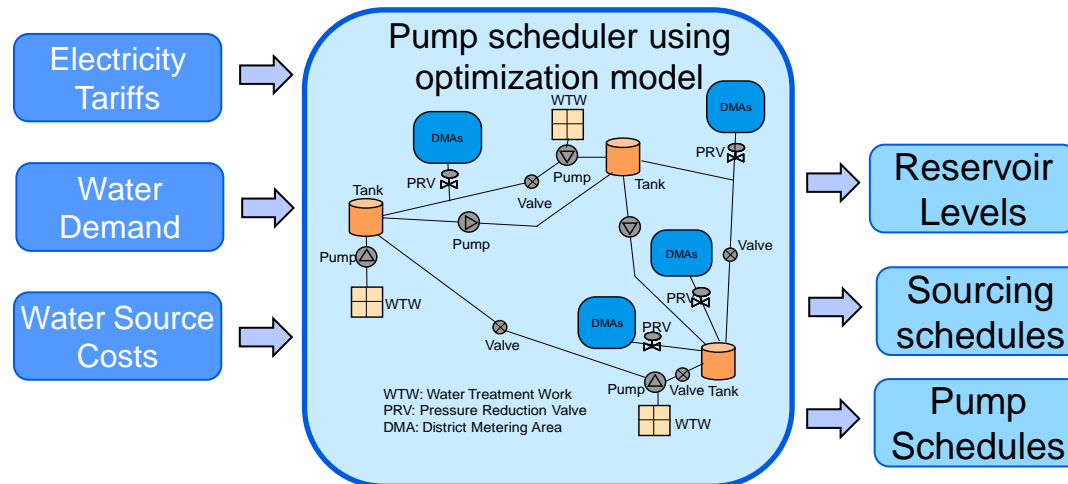
- Optimal energy usage
- Reduced pumping and water costs

How?

- Optimized 24h pump, water storage and sourcing schedules using hydraulic model, electricity tariffs, weather forecasts, water demands, source costs

Benefits

- Energy/cost optimal schedules
- Online (re)calculation of optimal schedule
- Consideration of maintenance schedules
- Automatic model simplification routine



Summary

ABB System Solutions for Water Distribution

- Functional enhancement of operation management as important step to manage challenges
 - Pressure management
 - Energy Management
 - Leakage Management
 - Operational decision support
- Modularity of concept to address individual customer needs
 - Different principles provide for different optimization objectives
- Supports enhancement of productivity: increase of operational effectivity and efficiency
- ABB delivers complete system solutions for water distribution
 - Complete scope of instrumentation, control, electrification (ICE)
 - Extension of portfolio with advanced solutions

ABB Systems Approach Solutions at Your Fingertips



**ABB as your
reliable
partner!**

**Think Water –
Think ABB !**

Power and productivity
for a better world™

