

WP6.1 – Long-term Water Supply Network Planning Under Uncertainty

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Research objective

We aim to develop a robust decision-support toolbox that will generate reliable long-term water system planning, with no-regrets principles explicitly embedded

- Robust against different types of severe uncertainties
- Operationally feasible and optimal
- Switchable to a decentralized model

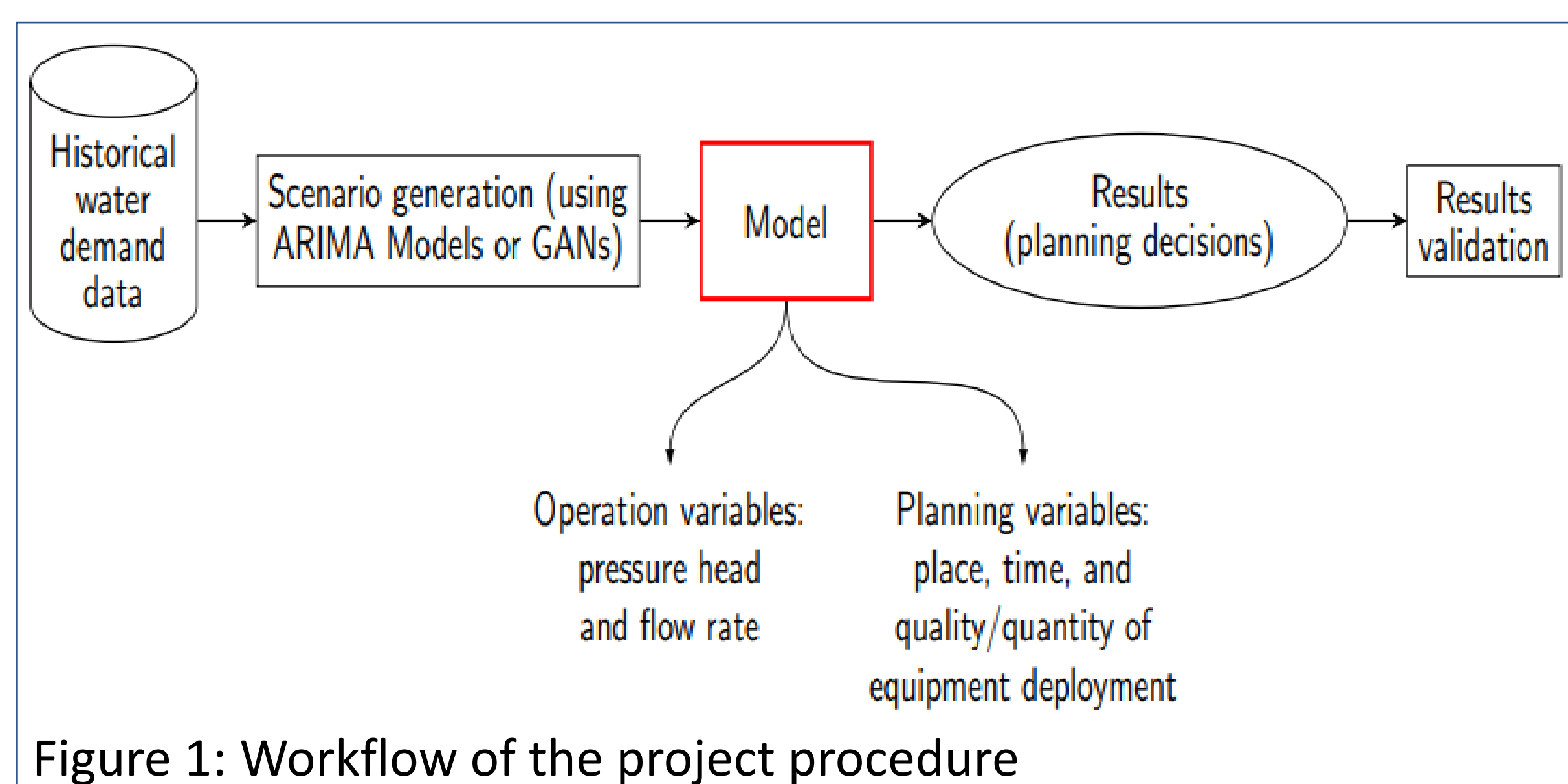


Figure 1: Workflow of the project procedure

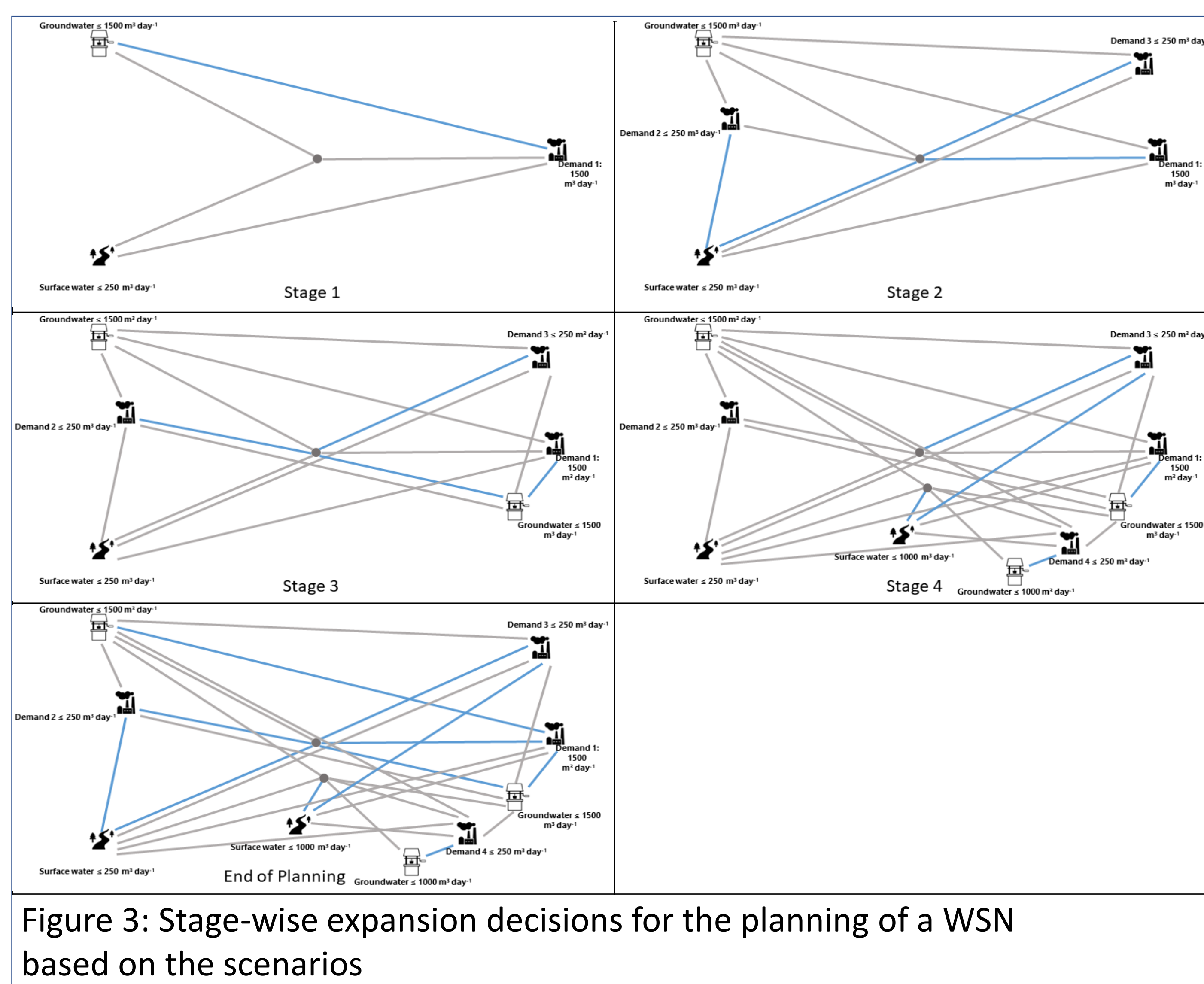


Figure 3: Stage-wise expansion decisions for the planning of a WSN based on the scenarios

Results

The results obtained since the last general assembly:

- Extending the two-stage stochastic programming model for planning of WSN to a multi-stage model
- Formulation of pump scheduling problem (OWF) for a WSN considering uncertainty on water demand and electricity price
- Solving the deterministic equivalent of the developed OWF problem

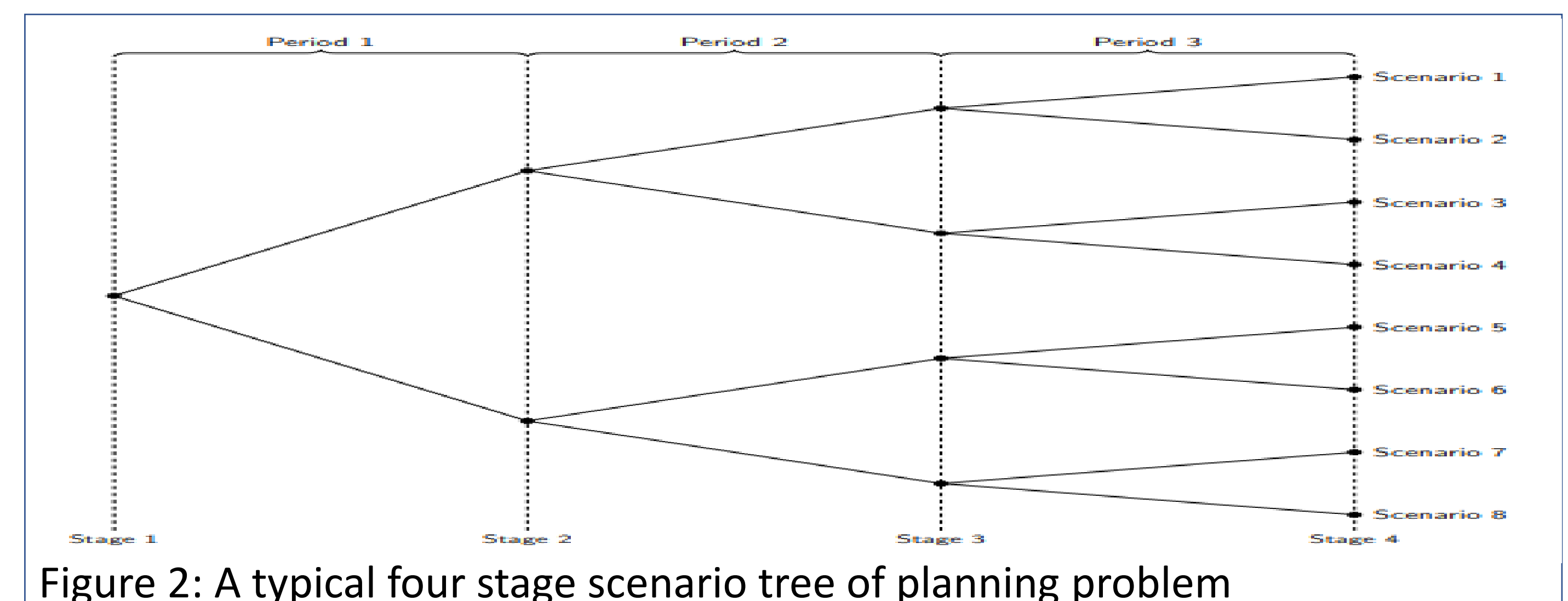


Figure 2: A typical four stage scenario tree of planning problem

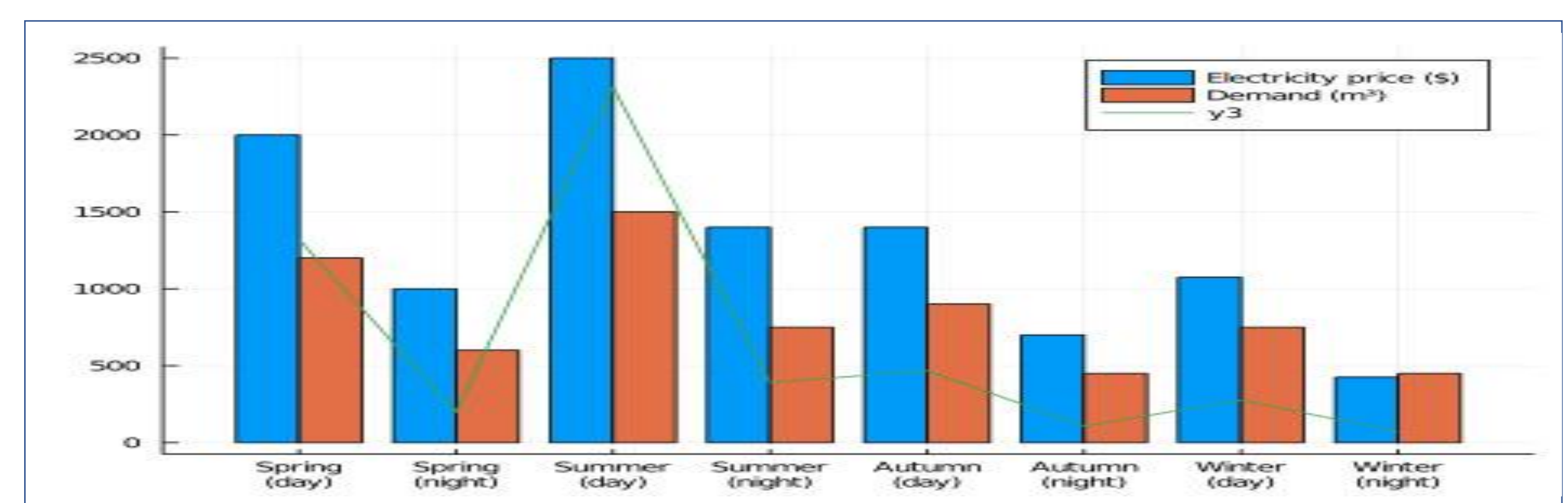


Figure 4: Operation cost of the WSN (stage 3) considering seasonal changes in water demand and electricity price

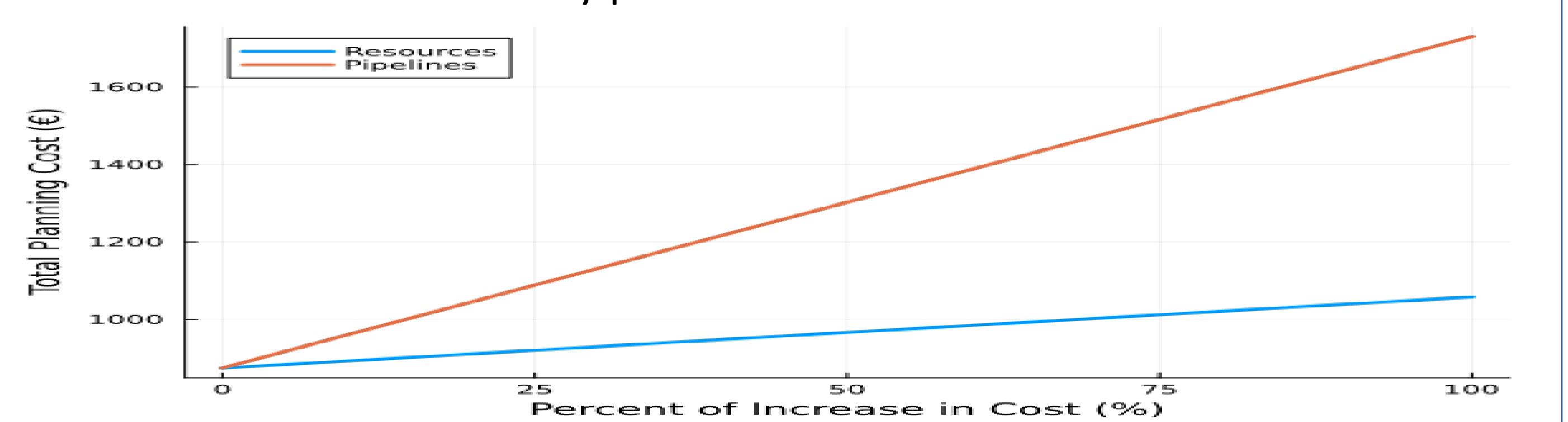


Figure 5: sensitivity analysis of the planning problem to different costs

Future plans

- Application of decomposition and relaxation techniques to reduce the computational burden of the planning problem
- Generating realistic scenarios for representing the changing trend of water demand and available resources
- Using multi-agent approaches to develop a decentralized structure for future WSNs
- Considering water quality aspects in the framework of the developed planning model

Take-home message

- The long-term planning of WSN is strongly affected by uncertainties on both the demand and resource sides.
- Cost-efficient and environmentally friendly expansion of infrastructures requires utmost care of severe uncertainties.
- We look at a real-world WSN and corresponding historical data to verify the developed multi-stage planning approach