# Scenarios for drinking water and waste water in the Ruhr area

**RUFIS**
**Ruhr-Forschungsinstitut für Innovations- und Strukturpolitik e.V.**

**Universitätsstr. 150**
**D-44801 Bochum**

# Outline

- RUFIS, dynaklim
- Water demand 2010
- Influencing factors and consumption areas
- Climate influence
- Building scenarios
- Future Consumption of drinking water
- Scenario results
- Daily consumption of drinking water in the future
- Conclusion
- Further use of scenario analysis

# RUFIS

**RUFIS**

Founded 1979 by Prof. Klemmer
Economic research and consulting service for administrations

**Competences**

- Fields of research: regional economics, structural development, environmental policies, climate change adaptation issues, alternative transportation systems
- Focus issues : co-operation between public and private actors (individuals and companies) and the respective incentives for obstacles this co-operation
- quantitative and qualitative aspects

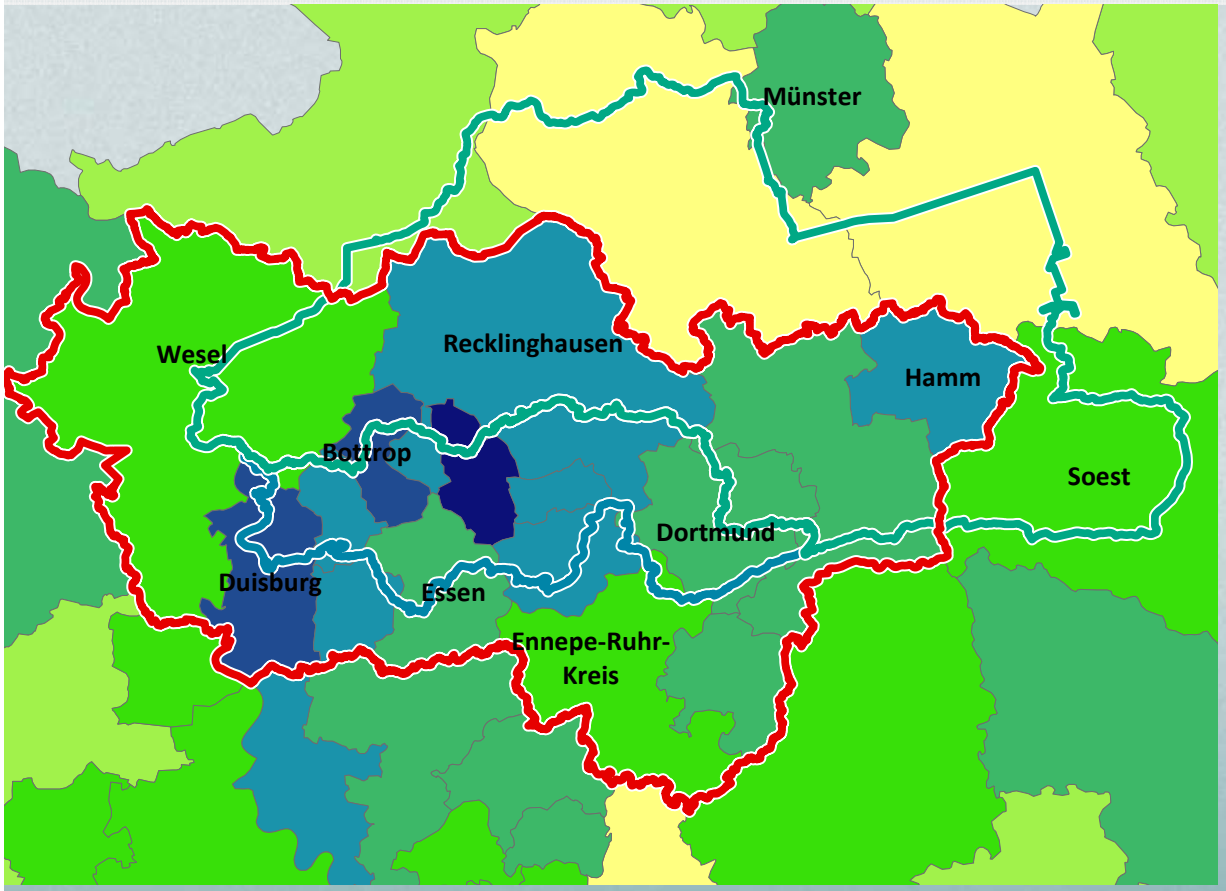
**References (sel.)**

- *dynaklim* – Climate change: dynamic adaptation of the Ruhr area
  - *To much water? Climate change and emerging high-water-risks*
  - *Water scenarios for the Ruhr area*
  - *KlimaFLEX – Decision support system for administrations*
  - *ADAPTUS – Climate check for enterprises*
- AKWA: Contracting in the fields of water management
- Quality improvements for the Wupper

# *dynaklim* - scenario analysis

- Research project supportet by the BMBF
- Support 2009-2014
- Subject: Climate change adaptation in the Ruhr area
- Part 6: Funding and organization of water-related services
- Modelling the basic conditions for water management:
  - Change of expected flood damages
  - Water scenarios for the Ruhr area

# Total water demand 2010

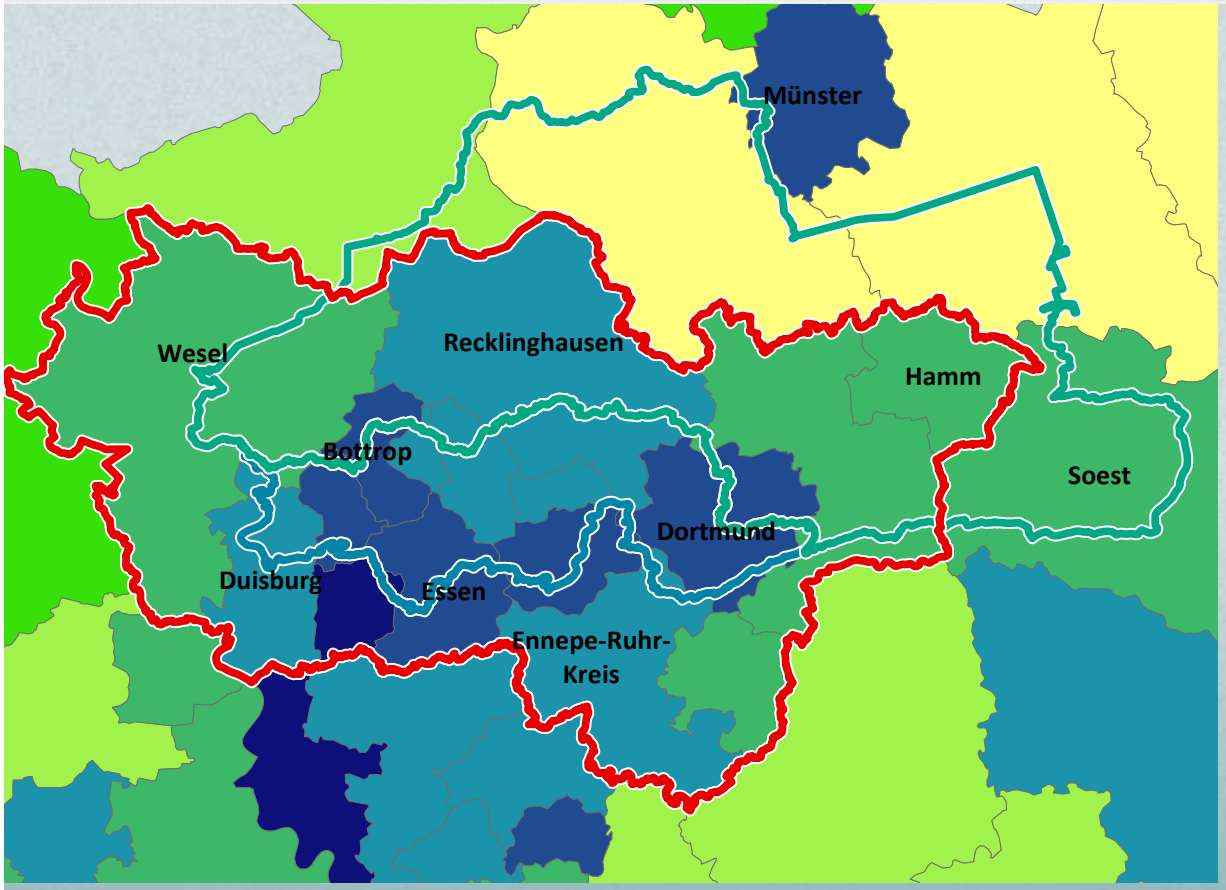



- Water consumption (total)
- Litres per inhabitant per day
- Public water supply

**Water consumption (total)**
**Litres per Inh. and day 2010**
**Public water supply**

| | |
|---|---|
| 375,3 - 702,7 | RVR |
| 215,5 - 375,2 | Emschergenossenschaft |
| 167,8 - 215,4 | Lippeverband |
| 149,5 - 167,7 | |
| 137,3 - 149,4 | |
| 123,5 - 137,2 | |
| 118,5 - 123,4 | |

# Water demand by households 2010

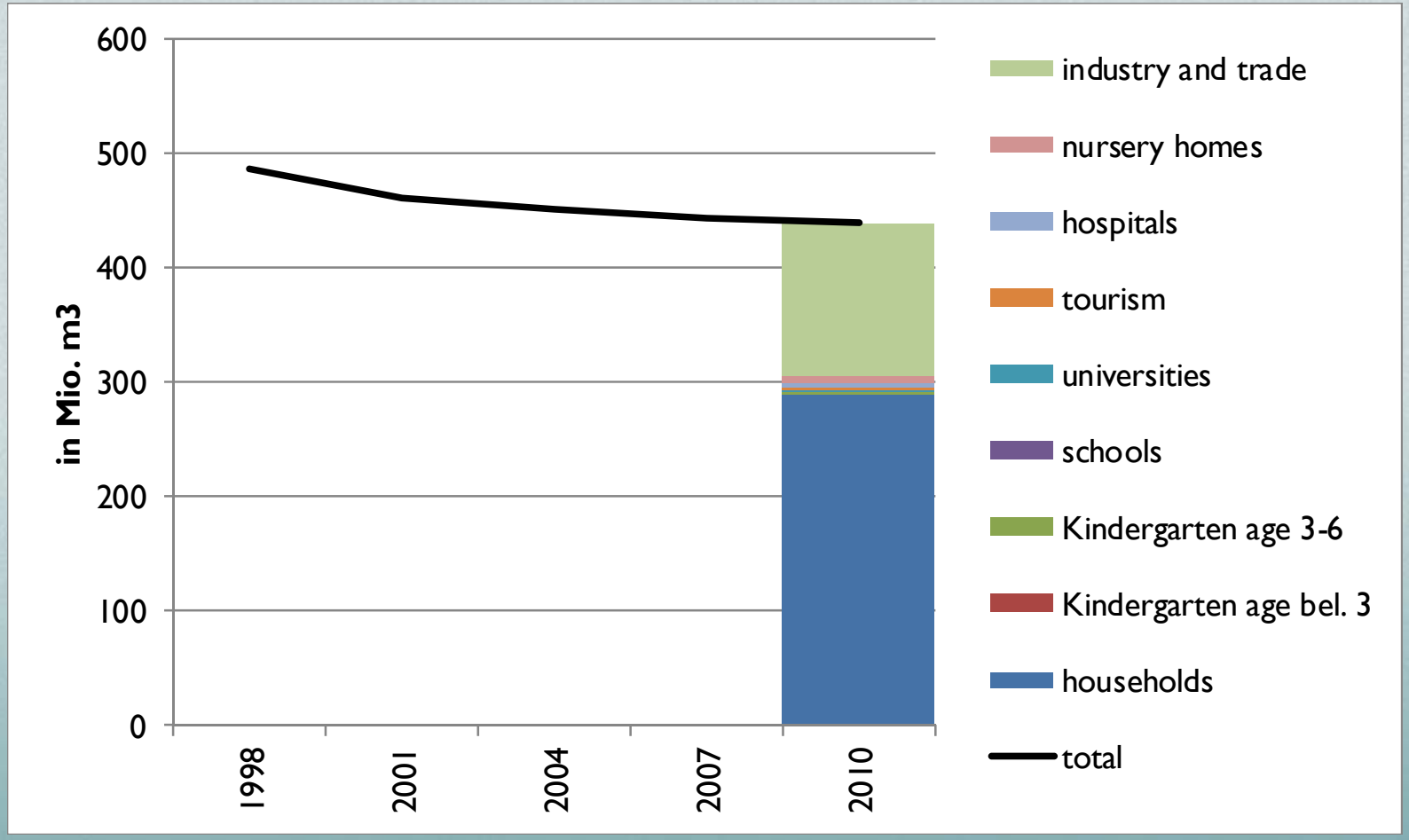



- Domestic use
- Litres per inhabitant per day
- Public water supply

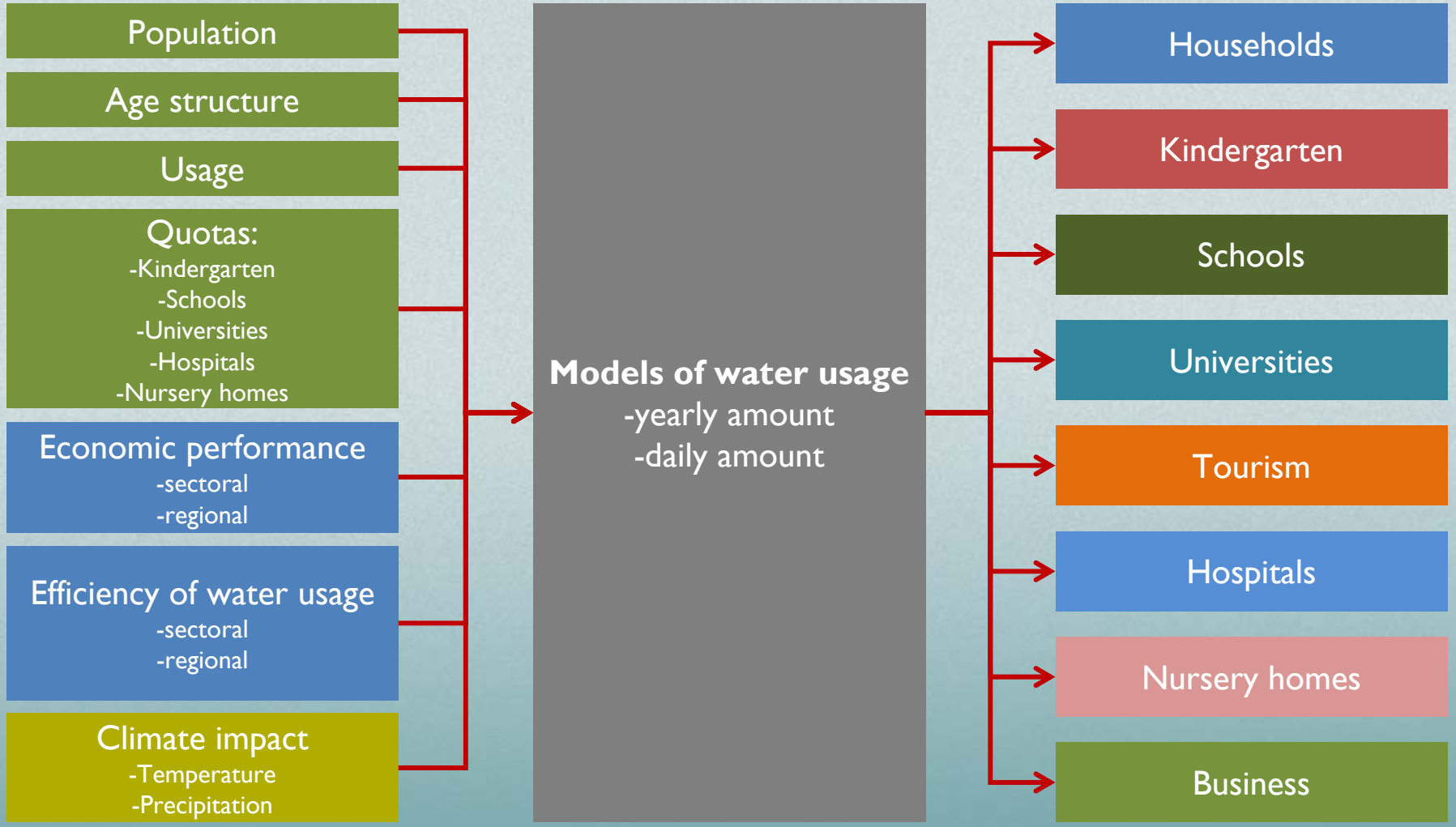
**Water consumption (households)**
**Litres per Inh. and day 2010**
**Public water supply**

| | |
|---|---|
| 158,8 - 175,8 | RVR |
| 143,7 - 158,7 | Emschergenossenschaft |
| 132,6 - 143,6 | Lippeverband |
| 124,9 - 132,5 | |
| 119,1 - 124,8 | |
| 110,3 - 119,0 | |
| 103,9 - 110,2 | |

# Consumption areas



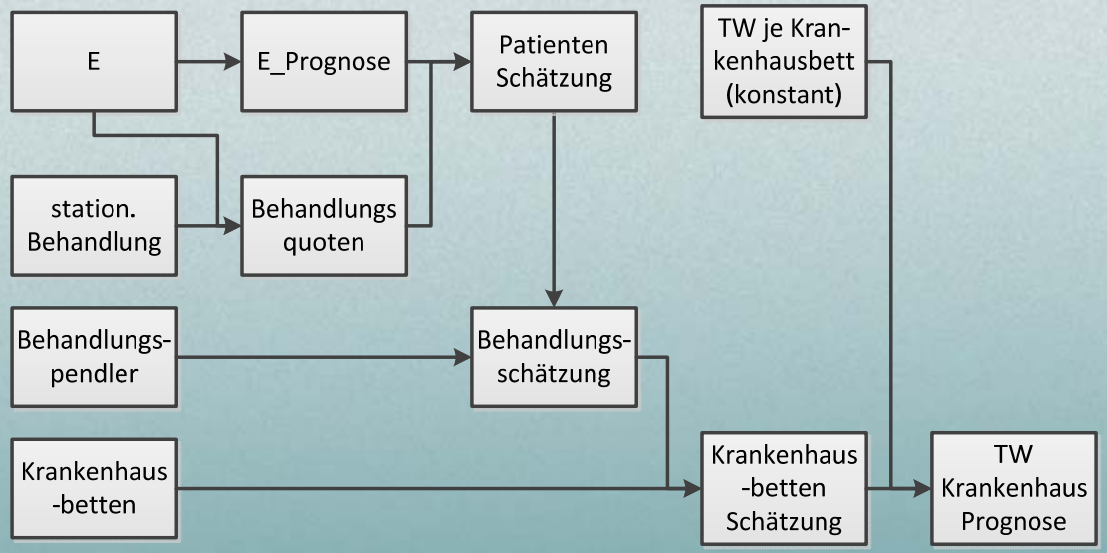
# Influencing factors and consumption areas



# Models of water consumption

e.g. domestic water usage


e,g, hospitals

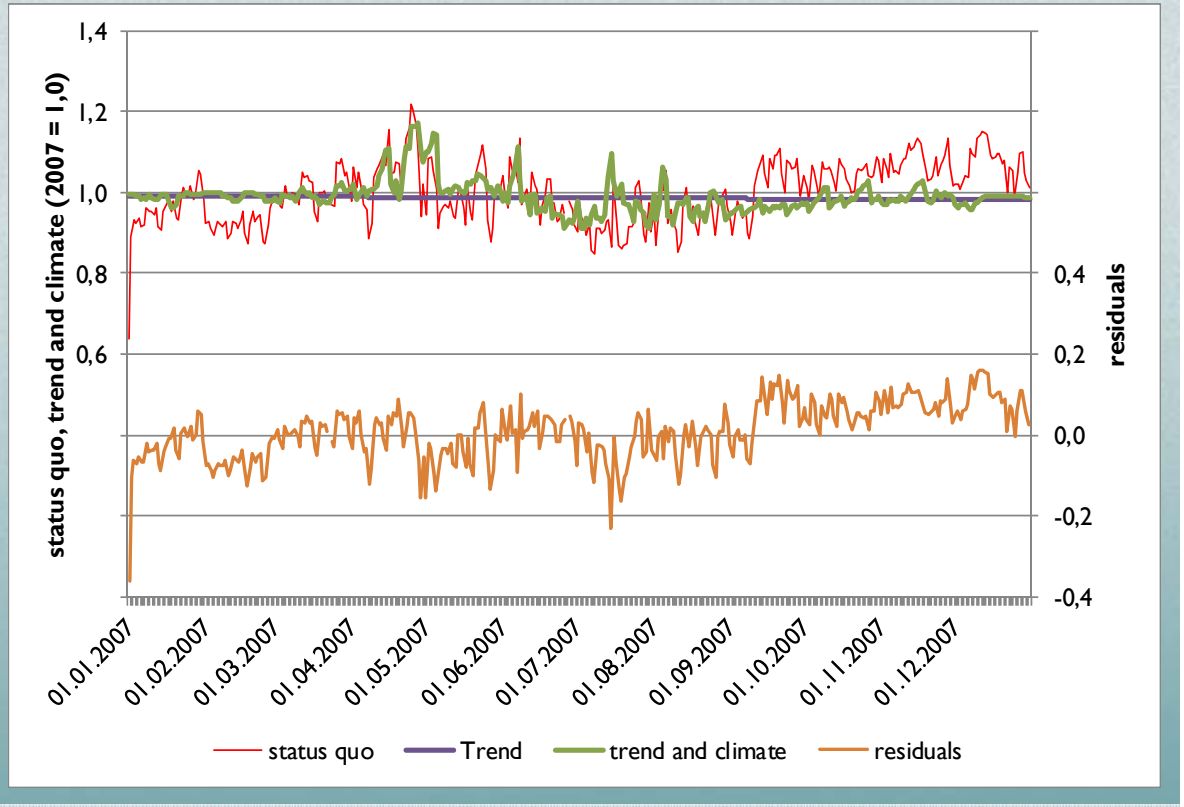



...

E=population
TW=drinking water

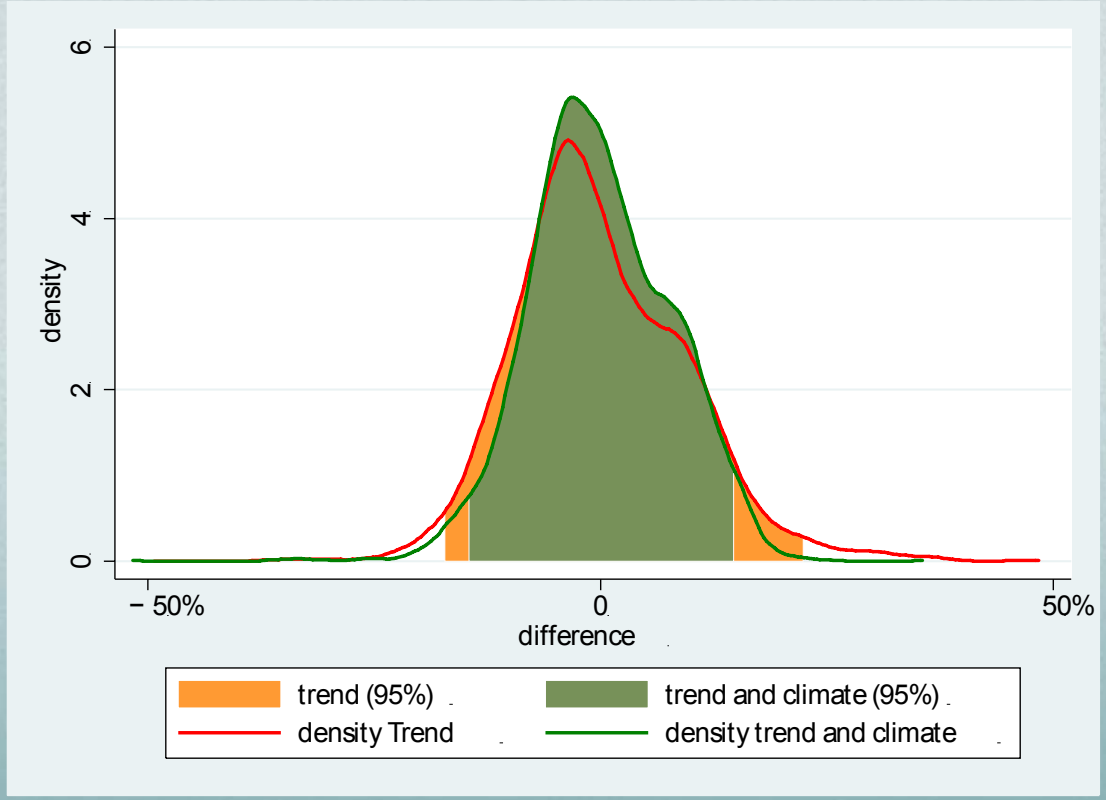
# Climate influence

- Data: daily water amount, temperature and precipitation, 2002-2010
- Breakdown
  - trend
  - daily variation
- Regression
  - weekends and holidays
  - seasons
  - temperature
  - daily precipitation
  - yearly precipitation
  - number of dry days
  - → *daily variance*
- Results
  - trend (purple)
  - explained variance (green)
  - unexplained variance (residual, orange)



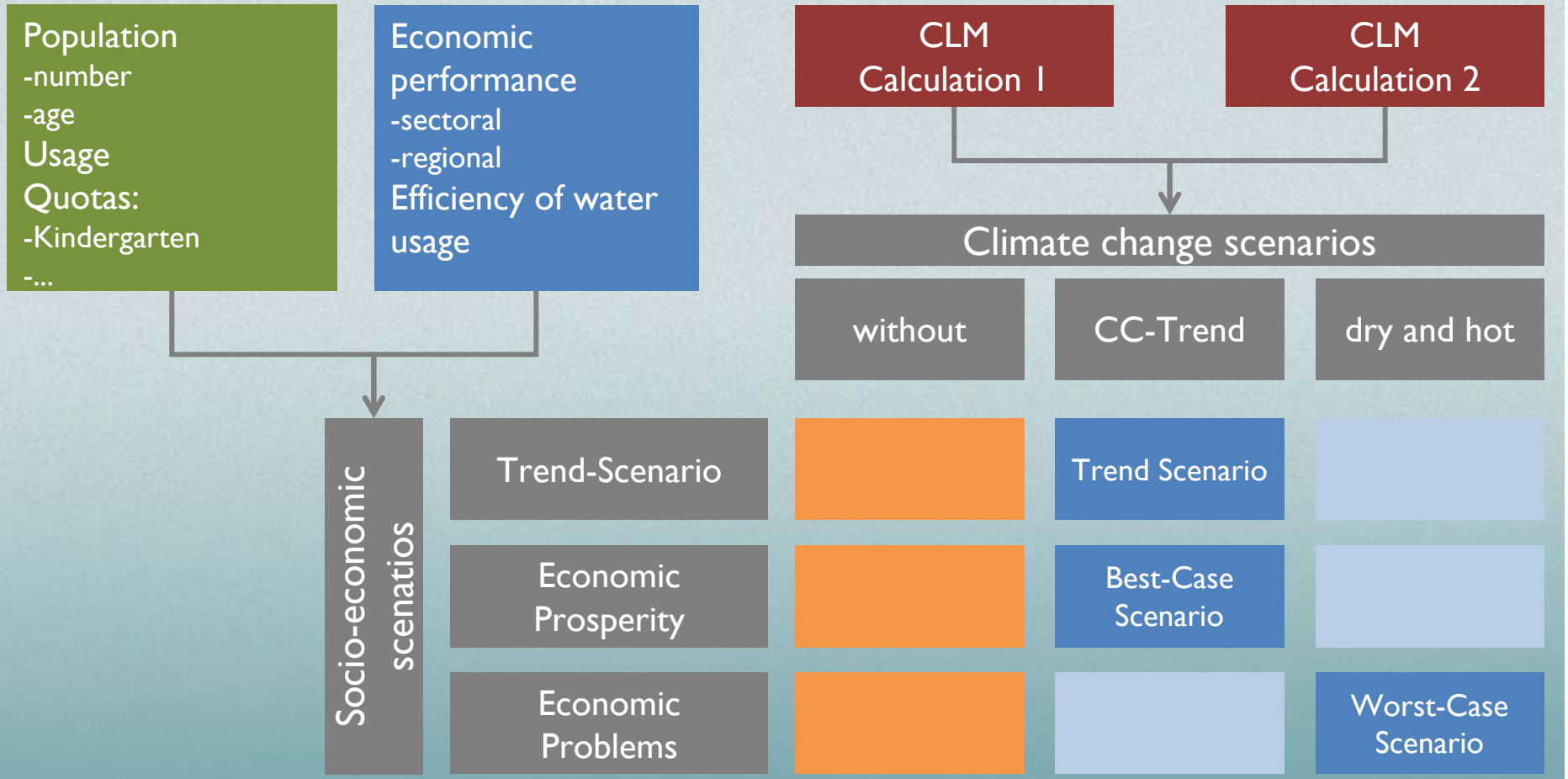
# Improvement of the explanatory power

- daily variance without climate factors:
  - skewed distribution
- Accounting for climate/weather influences
  - symmetrical distribution
  - explanation of positive variances
- Reduction of non-explained Variance (bandwidth green vs. orange)

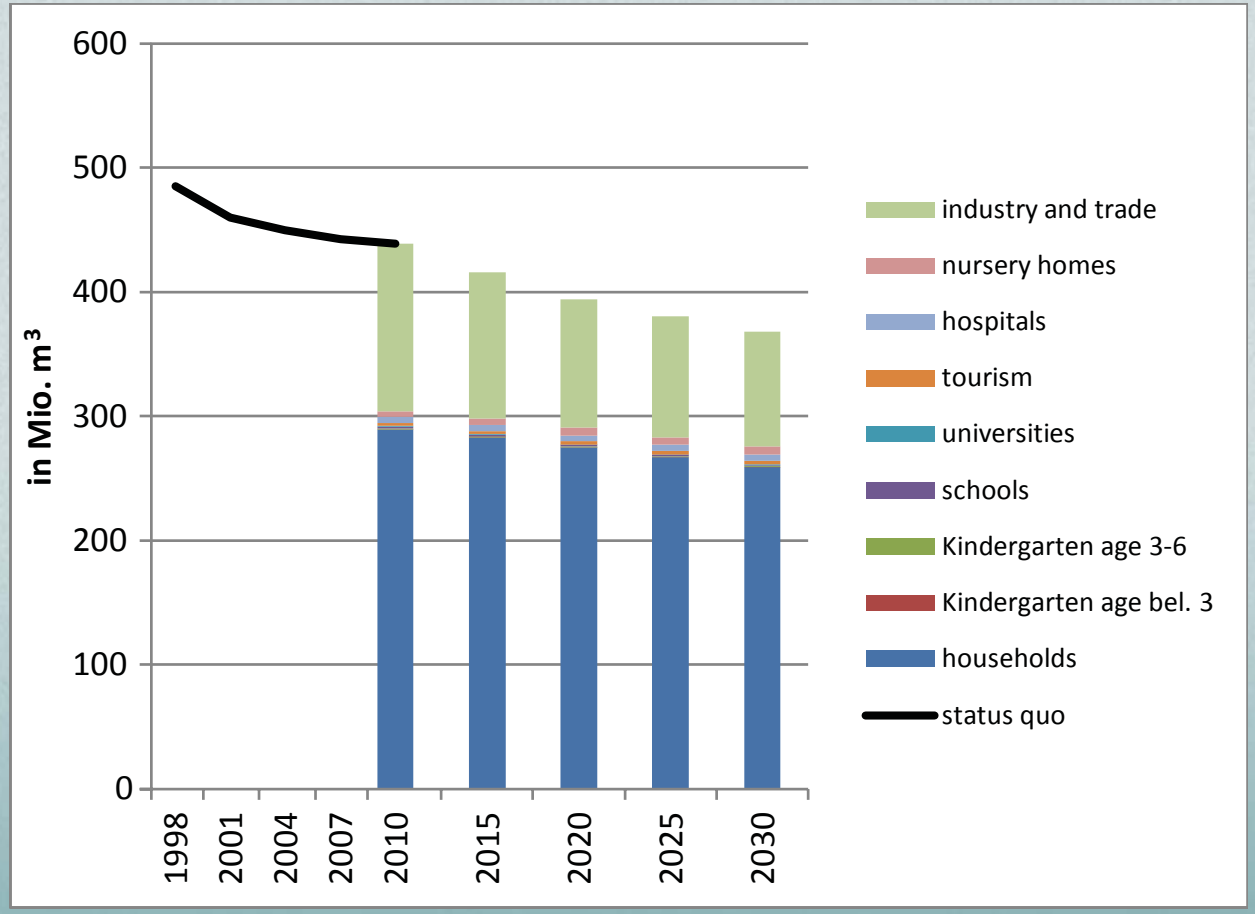


# Building scenarios

## Dynamic changes of influencing factors:

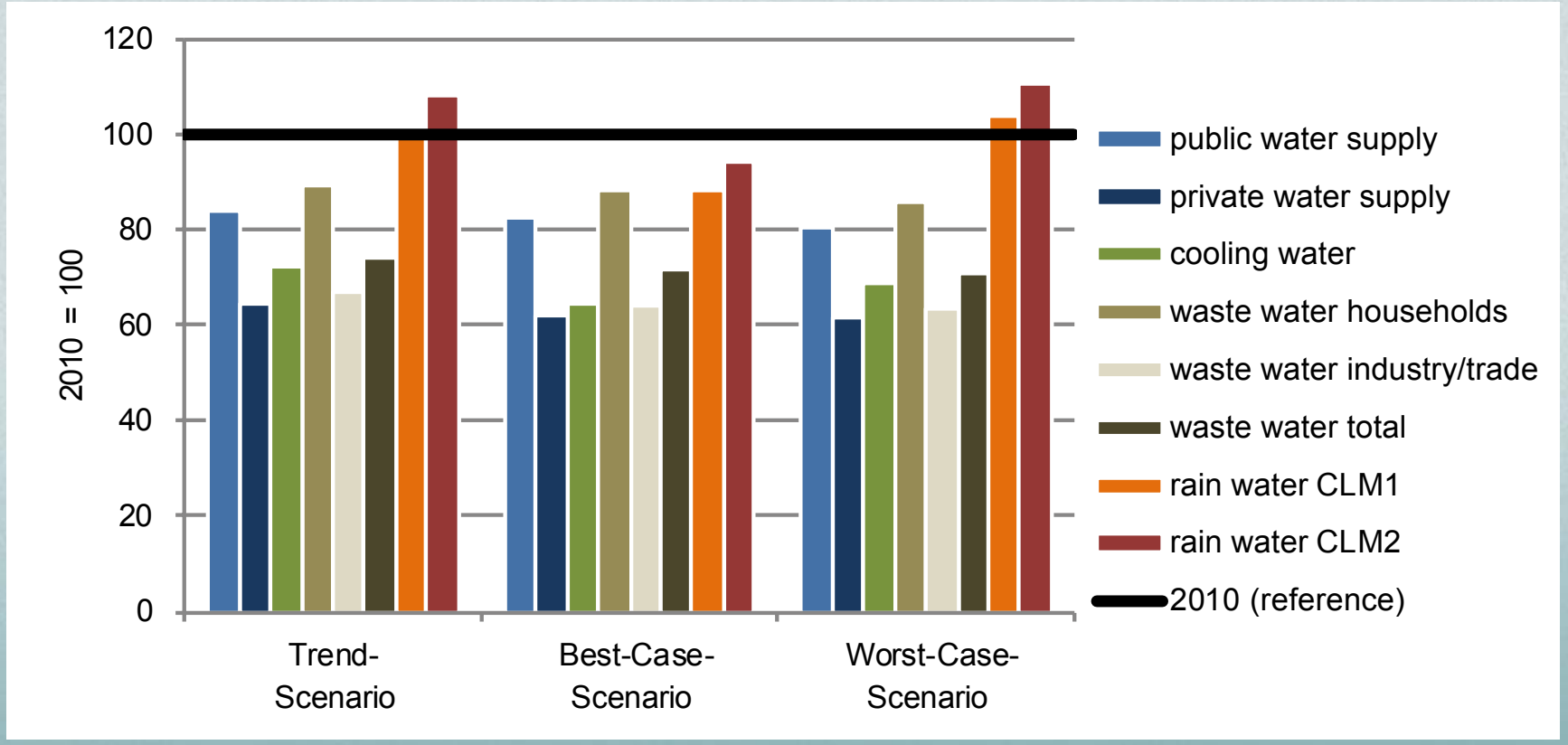


# Future Consumption of drinking water



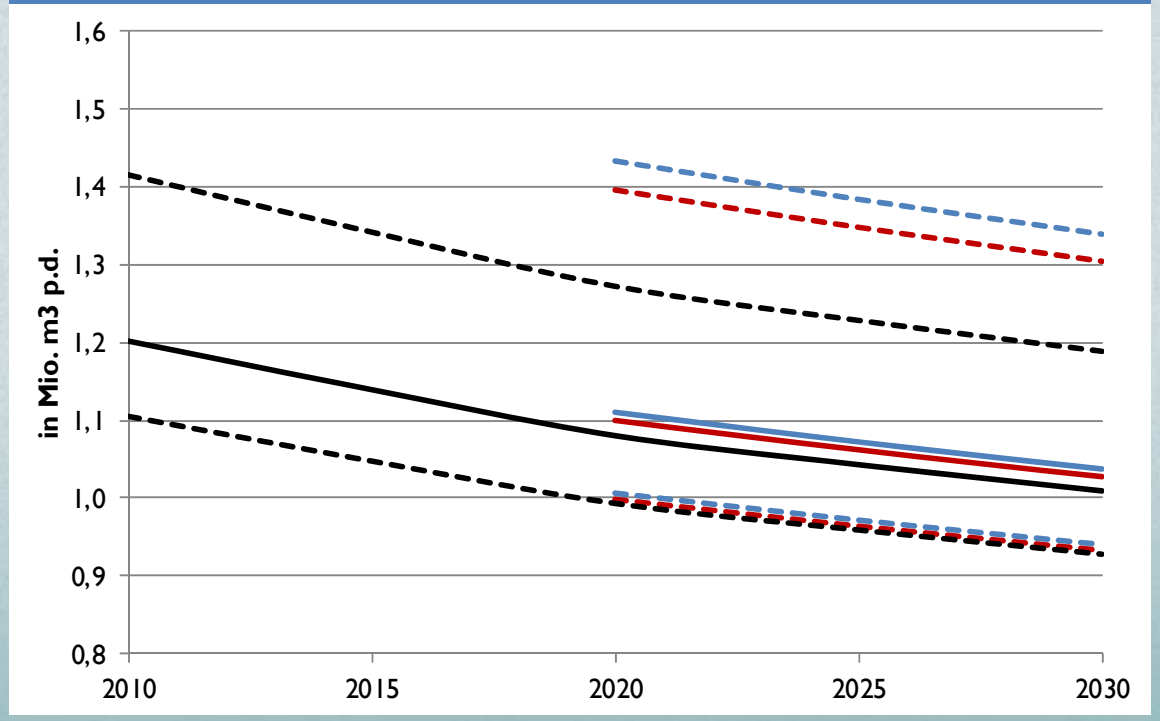

- Yearly consumption
- Trend-Szenario
- Without climate change
- Public water supply

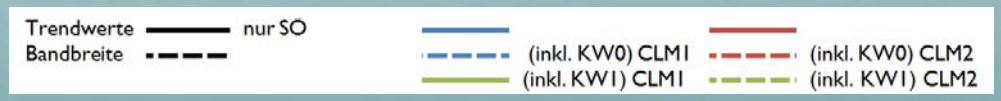
# Scenario results



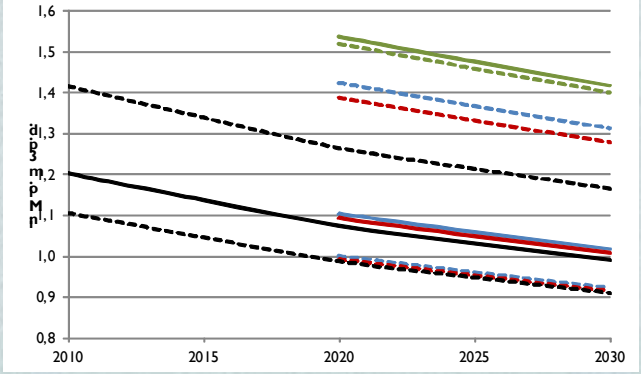
# Daily amount of drinking water

## Trend-Scenario

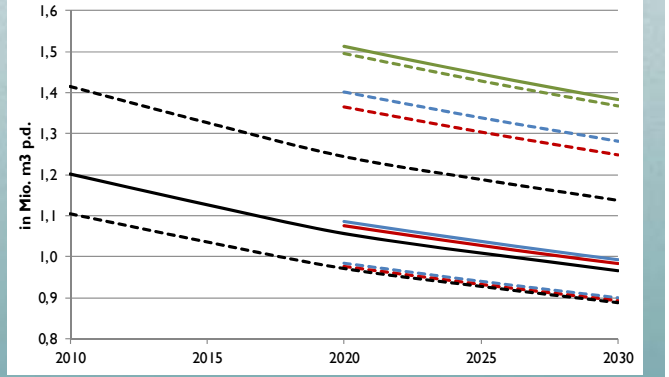



## Best-Case-Scenario




## Worst-Case-Scenario



# Conclusion

**Drinking water:**

- Total water amount sinks significantly
- Capacities to fulfil peak requirements can only be reduced to a minor degree
- In all scenarios

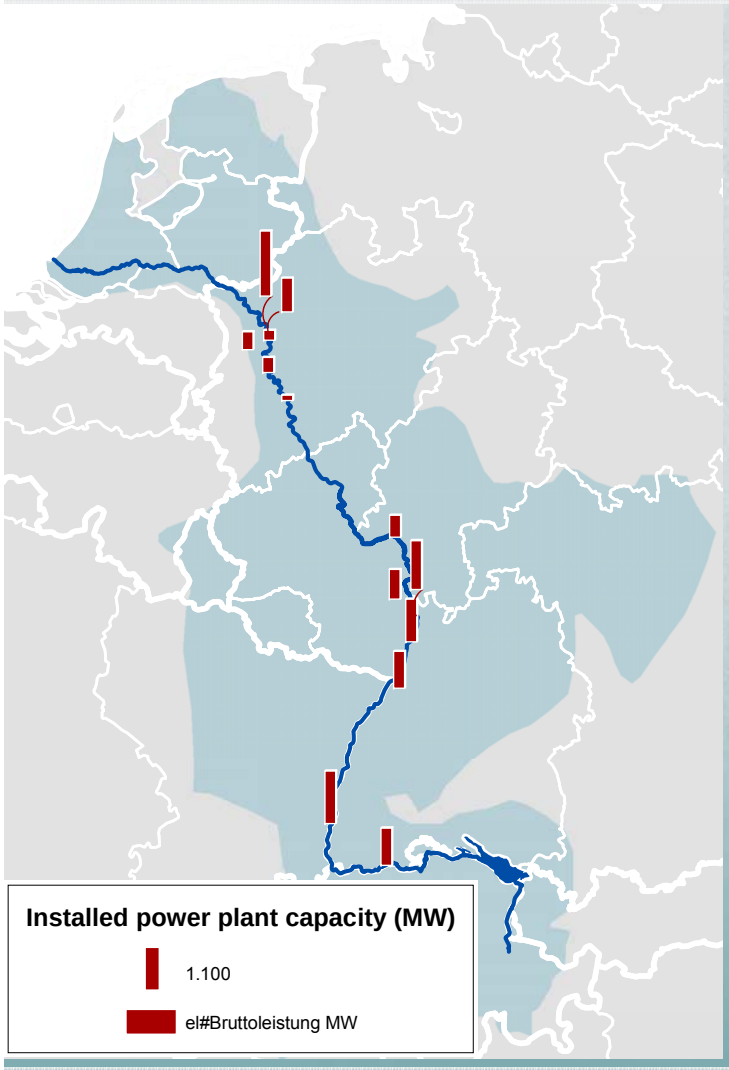
**Waste water:**

- General reduction of the total amount
- In all scenarios

**Rain water:**

- Dependent on implemented measures

# Future cooling performance for power plants




- Heat input into the rhine by cooling of power plants
- Further heat input, by e.g. industry, shipping
- Heat generation within surface waters
- Adverse effects for downstream riparians
- Impact of cooling measures for power plants

→ Future influences of human use

→ Future influences of climate change

→ Regulative requirements (e.g. Europ. Water Framework Dir.)

SCENARIOS → CRISIS SITUATIONS
→ EMERGENCY PLANS

*source: www.wikipedia.de*

# THANK YOU FOR YOUR ATTENTION

**Dr. Michael Kersting**

T: +49 234 32 25335
F: +49 234 707716
M: kersting@rufis.de

**RUFIS**
**Ruhr-Forschungsinstitut für**
**Innovations- und Strukturpolitik e.V.**

**Universitätsstr. 150**
**D-44801 Bochum**