Alternative Scenarios of Urban Water Infrastructure Systems

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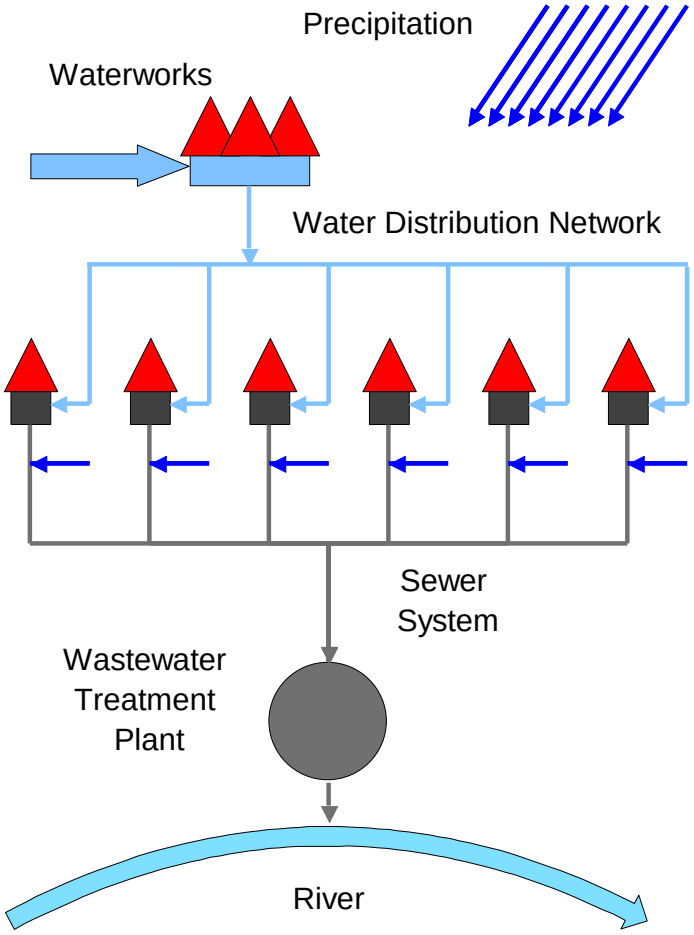
Outline

- Urban water infrastructure systems
- Challenges
- Strategic Foresight
- Centralization / decentralization
- Case Studies
  - The AKWA-2100 Project
  - The AKWA Dahler Feld Project
  - The DEUS 21 Project
- Conclusion

Conventional Urban Water Supply and Sanitation



- Concept of centrality (technical, institutional)
- Water supply (WS) utility institutionally independent of wastewater (WW) utility
- Regional Monopoly w.r.t WS und WW
- One-time use
- WS: Potable water quality for all uses
- WW: mixing various WW-streams
- High fixed costs

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Urban water infrastructure systems – the "hardware"

Technical Subsystem "Utilities":

Plants, equipment and network on public grounds for water supply, sanitation, strom water management

Technical Subsystem "Users":

In-house water using equipment and componentes / pipe systems for water supply and sanitation (incl. equipment for on-site water supply / sanitation)

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Challenges for Urban Water Infrastructure Systems (UWIS)

- Need for rehabilitation of UWIS and for renovation of stock of buildings (window of opportunity!)
- Increasing incompatibility between inhouse (users') and outdoor (utilities') subsystems of UWIS
- Need to adapt to demographic change (in D: deconstruction and urban renewal, inter-communal competition for residents)
- Need to adapt to climate change
- Vulnerability of existing conventional UWIS (terrorism, natural disasters)
- Unfavorable cost structure of conventional UWIS (fixed costs!)
- Increasing scarcity of important resources (e.g. phosphate, fossil fuels)
- New (regulatory) requirements (e.g. micro pollutants, pharmaceutical residues, hygienic load on receiving waters, ...)
- Systematic utilisation of continuous technological progress
- Provision of sustainable UWISs (urbanization in developing countries; MDGs)

If you don't know where you're going,
you may wind up somewhere else!

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Elements of Strategic Foresight

- Framing: defining the scope and focus of the problem requiring strategic foresight.
- Scanning: scanning the external environment for information and trends relating to the issue at hand.
- Forecasting: generating the widest range of creative possibilities, then consolidating and prioritizing the most useful for the organization to actively consider or prepare for as it moves forward.
- Visioning: bringing the consideration of the future back to the present by addressing the question, "So what?".
- Planning: evaluating the strategic options.
- Acting: creation of a comprehensive intelligence system to provide ongoing external and internal feedback on the efiectiveness of the strategy that has been implemented.

Organisational Innovations: Perspectives on (De-)Centralization

		Degree of (De-) Centralization		
		Complete Decentralization	Semi-Centralization	Complete Centralization
Perspectives	Technical Concept	Point-of-Use / Point of Entry treatment	Few small treatment plants (cluster systems)	Centralized treatment plant
	Ownership	Homeowner	(private or public) utilities, contractors, investors	(private or public) utility, contractor, investor
	Operation	Homeowner	Utilities, contractors	Utility, contractor

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AKWA 2100 Project (1)

- Project duration: 2000-2003
- Goal: Development of long-term scenarios of urban water infrastructure systems (time horizon 2050 +) with two municipalities as case studies:
  - Asseln (suburb of city of Dortmund): 9.200 inhab.
  - Bork (suburb of the city of Selm): 6.700 inhab.
- Assessment of sustainability of the scenarios
- Development of transition strategies from existing conventional system to a new concept as represented by a scenario (change management)

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AKWA 2100: Scenarios

Driving factors	Value	Scenario 1	Scenario 2	Scenario 3
Degree of Regulation	Regulated	X	X	
	Deregulated			X
Degree of Centrality	Centralized	X	X	
	Decentralized			X
Degree of differentiation of wastewater streams	Small	X		
	Medium		X	
	High			X
Degree of closure of anthropogenic water and material cycles	Small	X		
	Medium		X	
	High			X
Name of the scenario		Continuation	**Municipal Water Reuse**	**Local Recycling**

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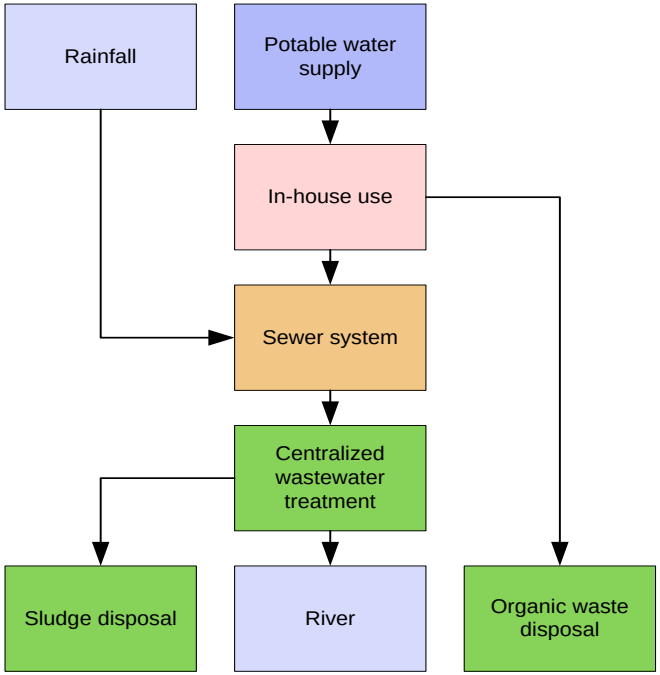
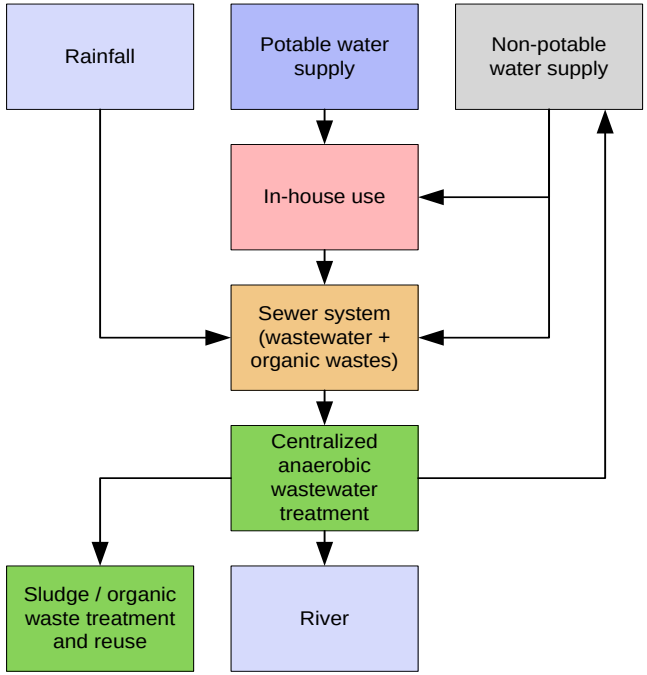
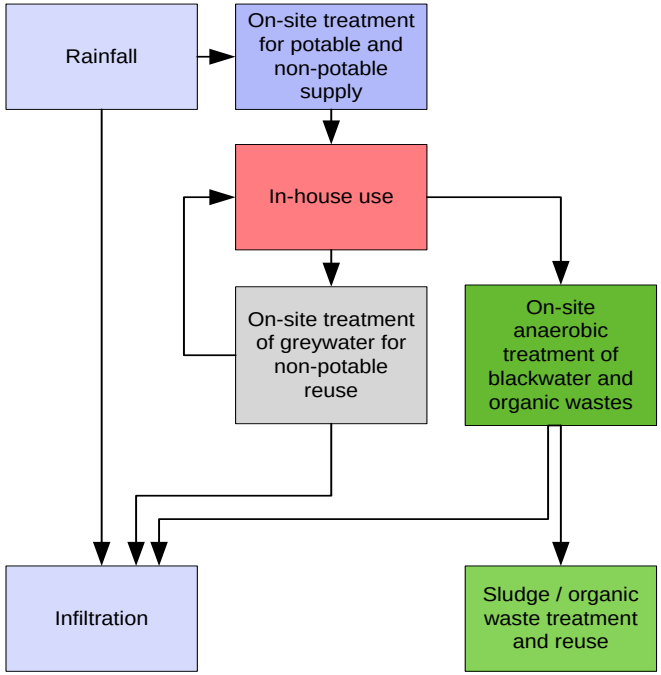


Scenario „Continuation“



Scenario „Municipal Water Reuse“



Scenario „Local Recycling“

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AKWA 2100: Cost assessment

		Additional costs as compared to reference scenario „Continuation“	
Case	Scenario / Concept	Dortmund-Asseln	Selm-Bork
A: „green field“	Municipal Water Reuse	**23 %**	**22 %**
	Local Recycling	**11 %**	**5 %**
B: „step-by-step“ Transition	Municipal Water Reuse	**27 %**	**26 %**
	Local Recycling	**15 %**	**11%**

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AKWA Dahler Feld, Selm (1)

Dahler Feld in Selm:

- Rural residential area (29 houses, approx. 100 inhabitants) on the periphery of the city of Selm (NRW)
- Individual water supply through private wells
- individual wastewater systems by private cesspits / septic tanks
- Need for renewal of the private wastewater systems
  (to meet new regulatory standards)

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AKWA Dahler Feld, Selm (2)

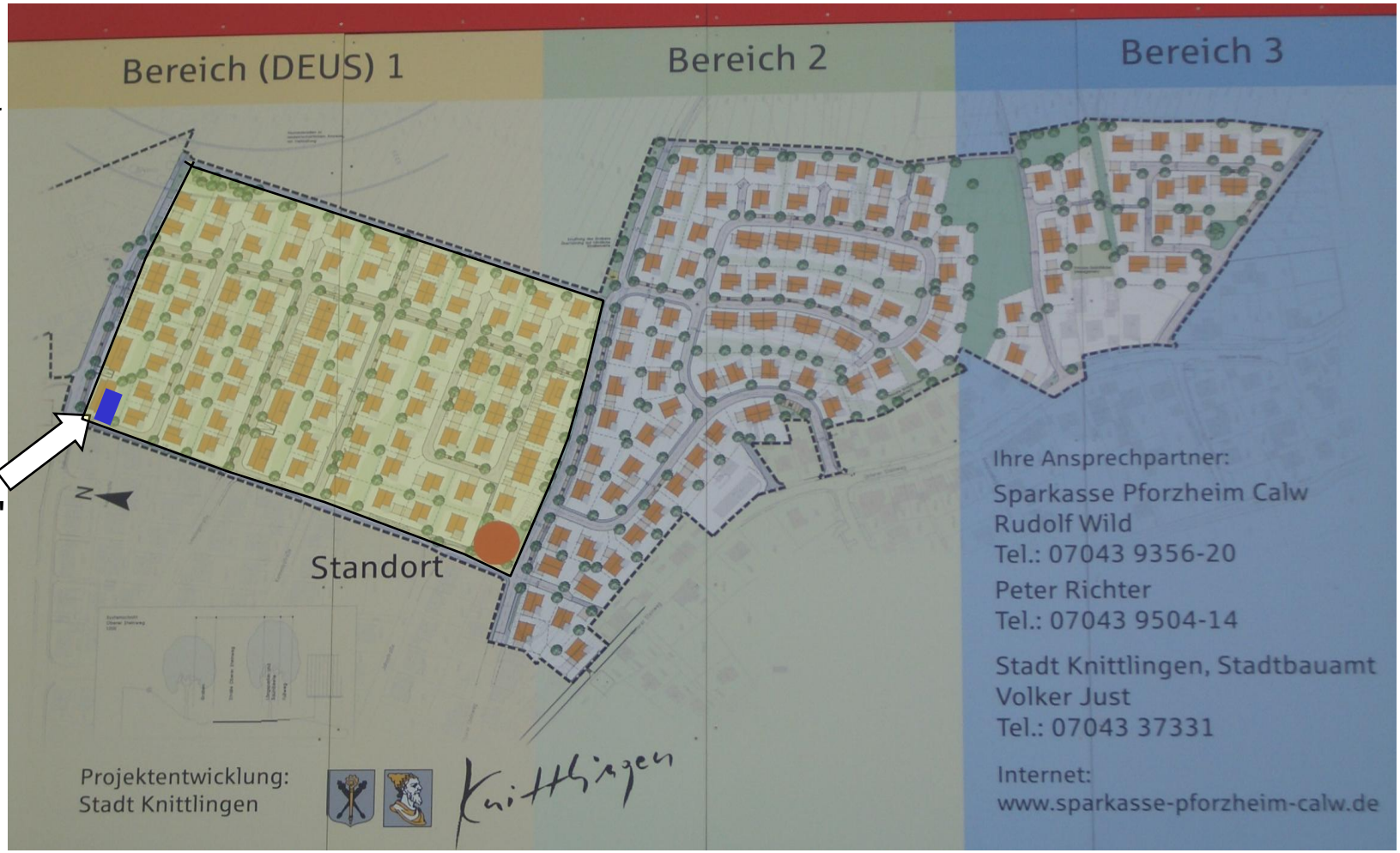
Modernisation of the wastewater management with a **contracting business model ("centralized operation of decentralized treatment units")** by the Lippeverband (LV) – a regional wastewater utility.

Advantages:

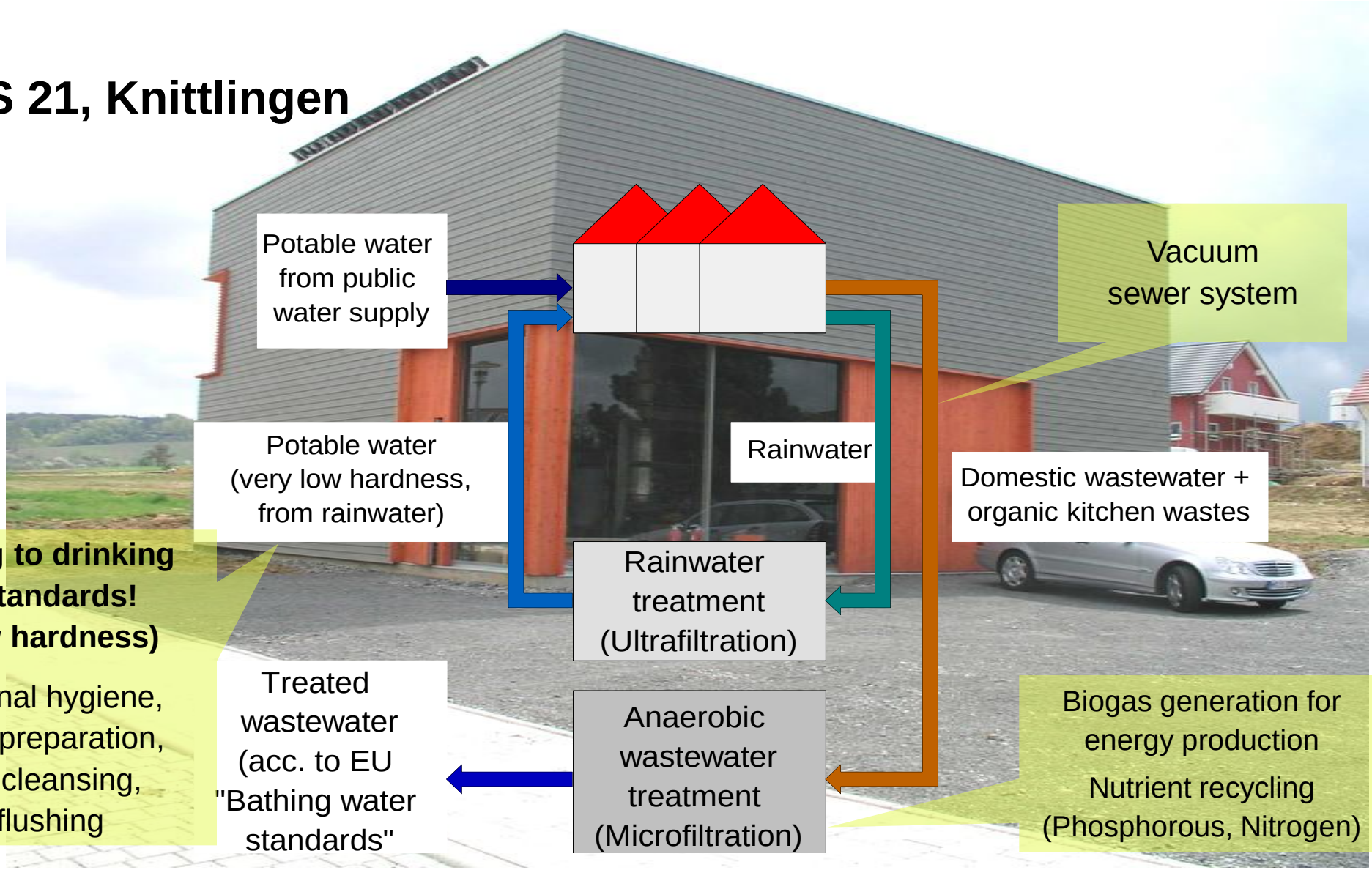
- LV provides innovative MBR-micro treatment units as part of long-term service contracts with the homeowners
- Cost cutting through bundling (procurement, construction, operation, maintenance)
- Home owners pay a fixed monthly fee for waste water services – no investments!
- Professional operation of the micro treatment plants
- Depreciation of the micro treatment plant assets through LV
- MBR-technology instead of conventional SBR-technology

DEUS 21 – Decentralized Urban Water Infrastructure System, Knittlingen

- New residential area for 105 houses
- Mostly single family homes
- At present: about 25 houses finished and occupied
- Site of "Waterhouse"



DEUS 21, Knittlingen



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Summary and Conclusions

- UWIS are complex (technical, socio-economic, judical, and institutional) systems with a large number of actors / stakeholders involved.
- Existing conventional UWIS are under pressure for a variety of causes. There is
  - a huge need for re-investments.
  - a window of opportunity for switching to sustainable systems concepts.
- Re-development: major issue is to initiate and manage system transition. Requires long-term thinking and systemic transition management!
- Technological as well as organizational and institutional changes provide new options for more sustainable UWIS in developed and developing countries:
  - Flexible UWIS concepts to allow for assimilation of technological change.
  - UWIS concepts need to realize synergies between various utility sectors.
- We need more pilots with innovative UWIS concepts to gain experience!

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Thank you for your attention!

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