



Practice of Wastewater Heat Recovery in Germany

Adrian Treis, 11th March, 2014, Tokyo



EMSCHER  **LIPPE**
GENOSSENSCHAFT EGLV.de VERBAND

... introducing: a river manager



What moves us



We manage the natural river areas of the rivers Emscher and Lippe



We are a service provider for water management



Together we are the largest waste water treatment provider in Germany

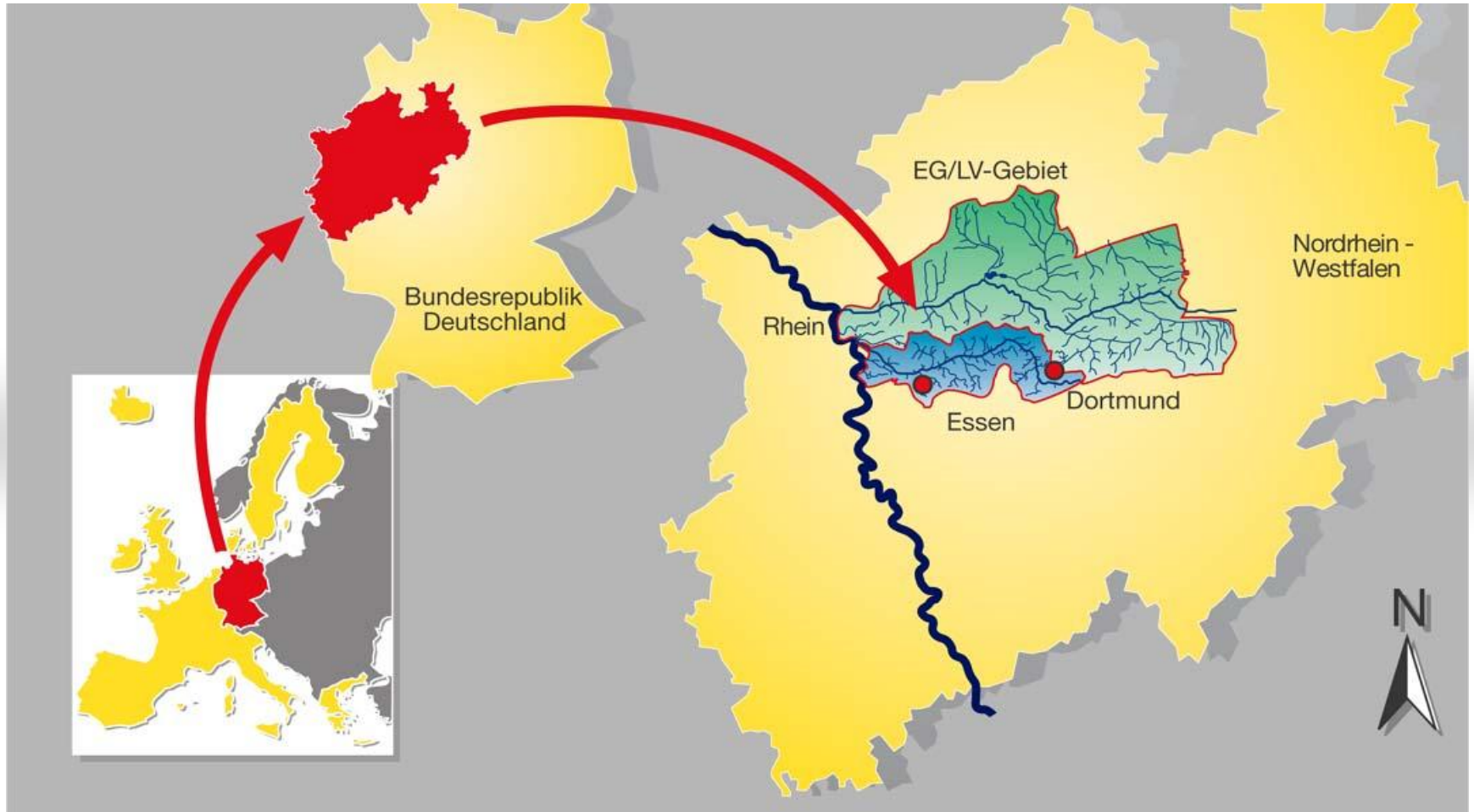


We are water management companies incorporated as statutory bodies under public law




We have been an administrative partnership for almost 100 years now


Our catchment areas

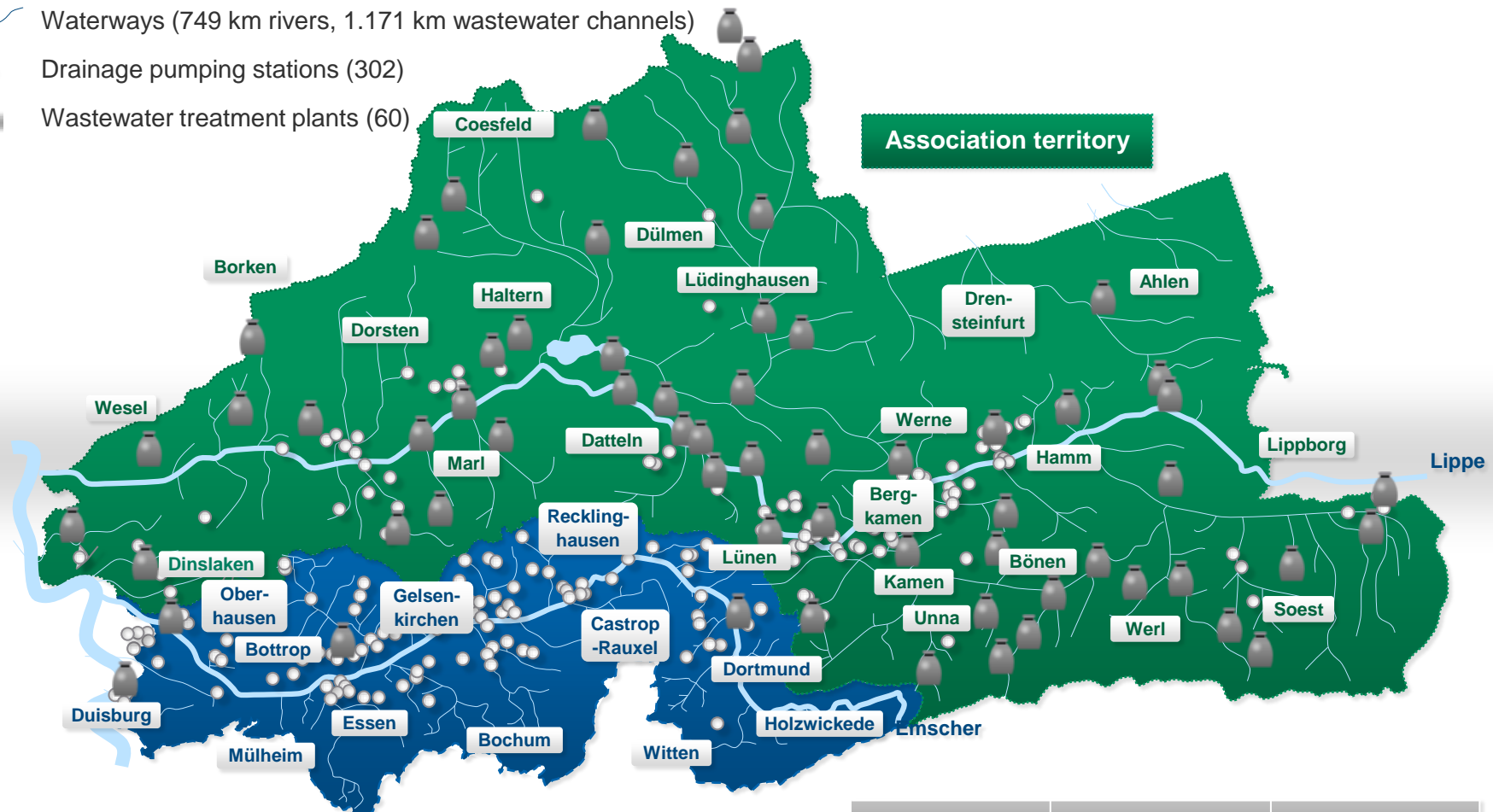


Our catchment areas

 Waterways (749 km rivers, 1.171 km wastewater channels)

 Drainage pumping stations (302)

 Wastewater treatment plants (60)



Association territory

	Area (km ²)	Inhabitants (mio.)	Inhabitants/ km ²
Lippeverband	3.280	1,4	427
Emschergenossenschaft	865	2,4	2.775

We take preventive action ...

Rain water management



**363 Facilities,
1.064.688 m³ Retention Volume**



Storm water retention basin Haarbach in Gladbeck



Example for decentralised rain water management

We take preventive action ...

Clean waterways



**60 Wastewater treatment plants,
Capacity: 7.4 Mio. Inhabitants**



Waste water treatment plant Dorsten-Wulfen



Waste water treatment plant Emschermundung

We take preventive action ...

Pump station operations and groundwater management



Groundwater sampling



302 Pump stations, 842 km² Polder areas

We take preventive action ...

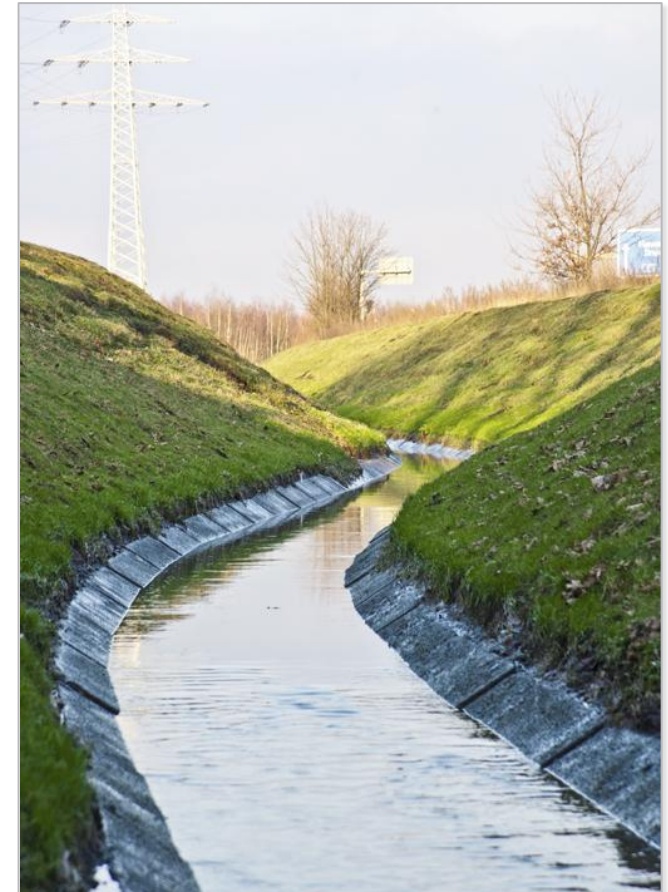
Flood management



193 km of dikes



53 Flood water retention basins,
3.8 Mio. m³ retention volume

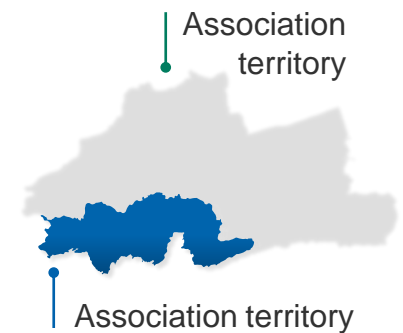


Dikes in Oberhausen

Economic indicators

2011

Balance sheet total	3.4	Bill. EUR
Capital assets	3.2	Bill. EUR
Profit	Non-profit	
Employees	1,554	





**The renaturation of the Emscher system as
a window of opportunities to wastewater
heat recovery**

The Emscher region about 1900



The status quo - open sewers

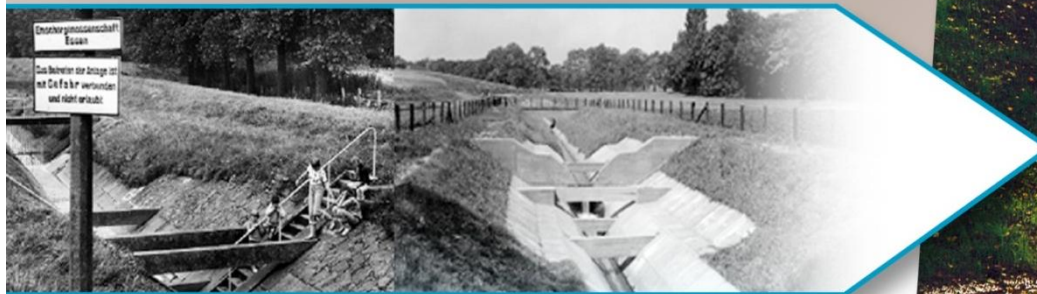
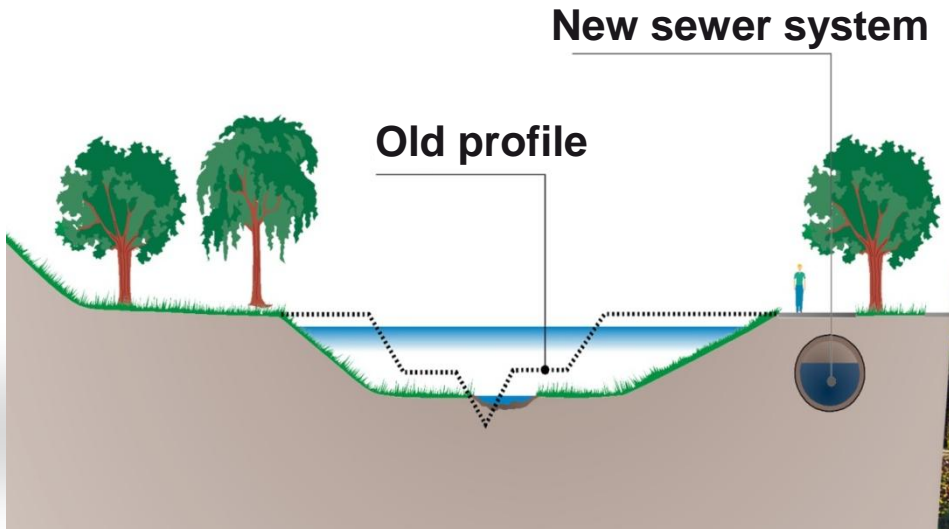


The 'schwatte' (black) Emscher symbolic of the 'old Ruhr region'



Emscher River renaturation

Future-Proof Water management



Emscher River renaturation milestones

The largest infrastructure project in the region

Budget: 4.5 billion euro

Construction of 4 decentralised waste water treatment plants

Channel construction completion scheduled for 2017

Renaturation of the waterways by 2020

Modern wastewater treatment plants

Constructed in the 1990ies



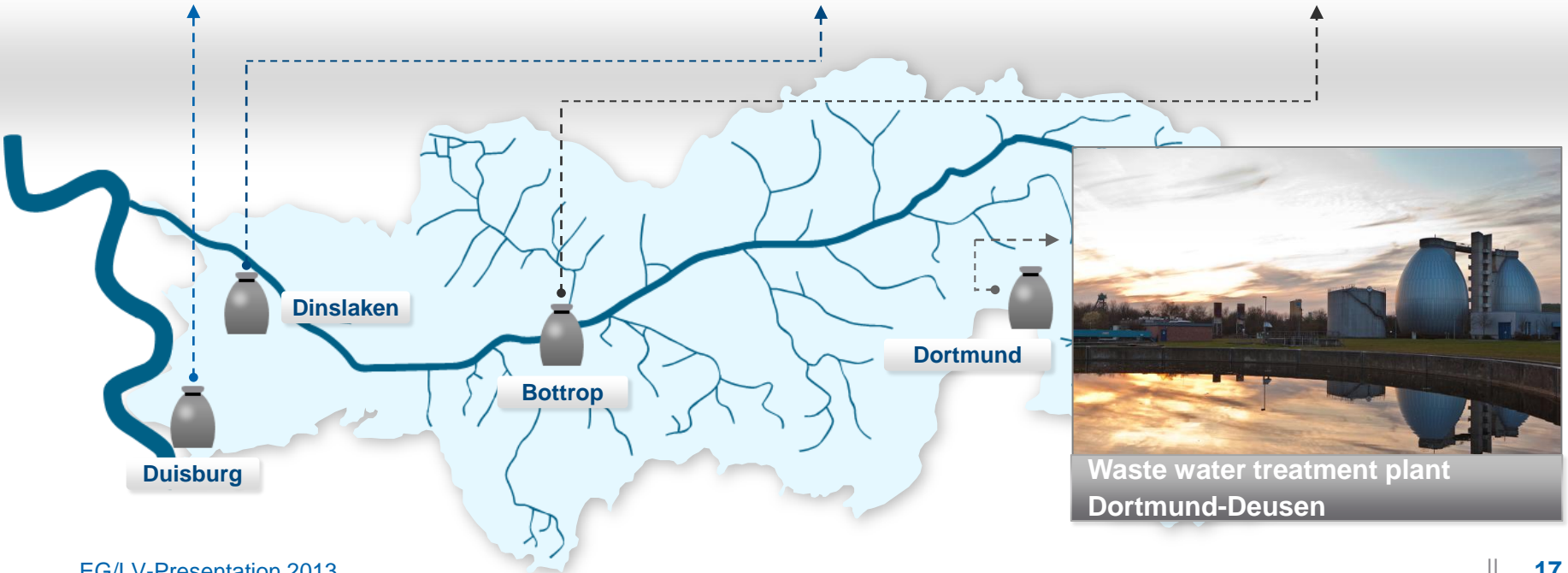
Waste water treatment plant 'Old Emscher'



Waste water treatment plant Emscher River estuary



Waste water treatment plant Bottrop



The open sewers

Main investment objective of the Emscher renaturation project

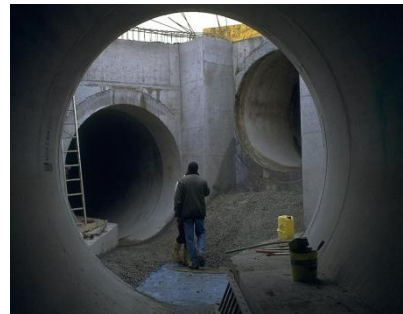
▶ **230 km**
finished
(of 400 km)

Window of opportunities to heat recovery from sewage



The Emscher renaturation project – Window of opportunities to recover heat from sewage

- Construction of 400 km of sewers in a highly urbanised area
- Consideration in the planning phase
- Savings in costs compared to construction during running operation
- Positive image -> the nuisance caused by construction of the new sewers is linked to a positive benefit
- Contribution to CO₂ reduction
- Operation of sewers and wastewater treatment plants by a single operator





Principles of heat recovery from wastewater

Principles of heat recovery from wastewater

Wastewater as a „natural resource“

Wastewater is a local, safe and renewable source of energy with long-term availability

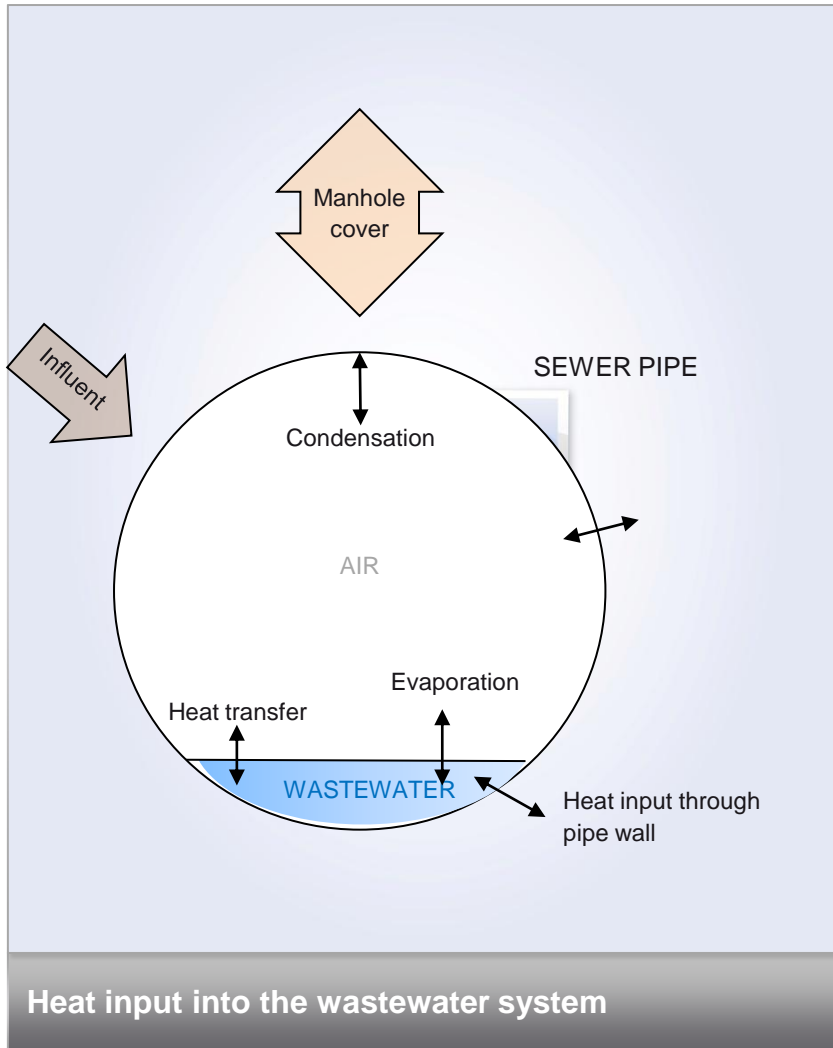
The heat supply is available almost always

Efficient energy recovery by heat pumps

Helps climate protection

Proven technology on the verge of profitability

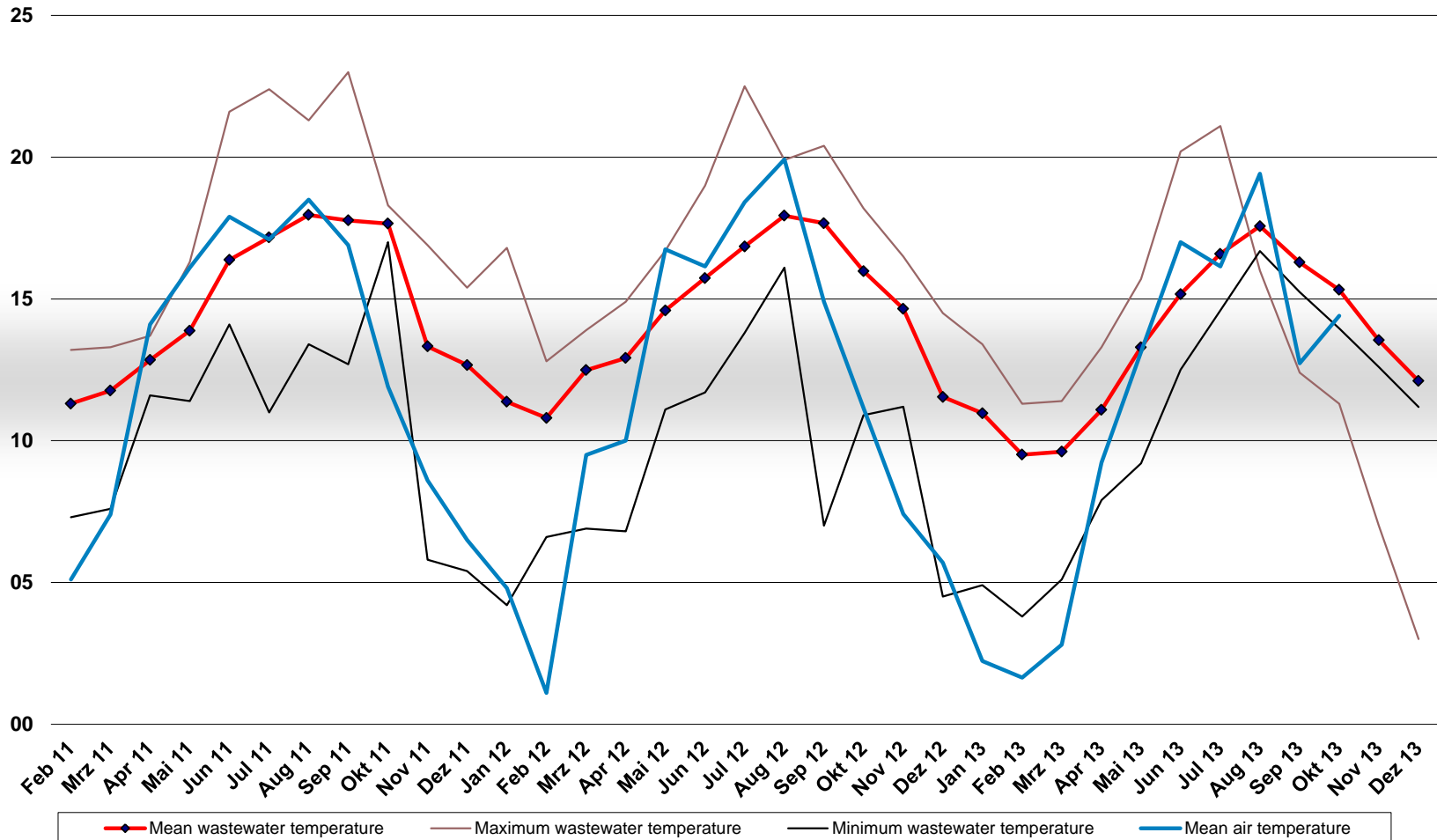
Heat input into the wastewater system



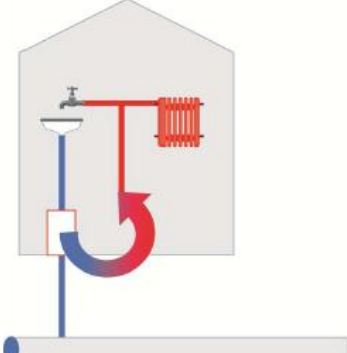
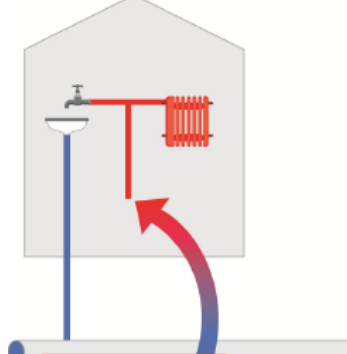
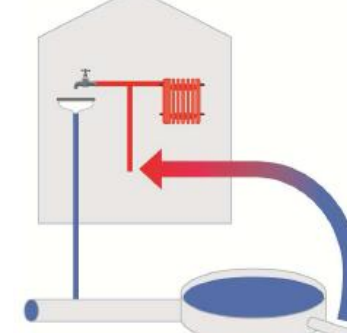
Principles of heat recovery from wastewater

Monthly wastewater temperatures

- Wastewater has a mean temperature of 15°C.



Possibilities of heat recovery

	<ul style="list-style-type: none"> + Relatively high wastewater temperature + Short heat transport routes + Network-independent operation + No permit required for operation 	<ul style="list-style-type: none"> - Low outflow - High fluctuations during the day - High operating costs - In part high specific investment costs
	<ul style="list-style-type: none"> + High wastewater volume + Reasonable operating costs + Short to medium heat transport routes + Increase in technical lifetime 	<ul style="list-style-type: none"> - Dependency on network operator - Permit required for operation - Influence on wastewater treatment possible
	<ul style="list-style-type: none"> + High wastewater volumes + Increased heat potential + No influence on wastewater treatment 	<ul style="list-style-type: none"> - Long heat transport routes - Permit required for operation

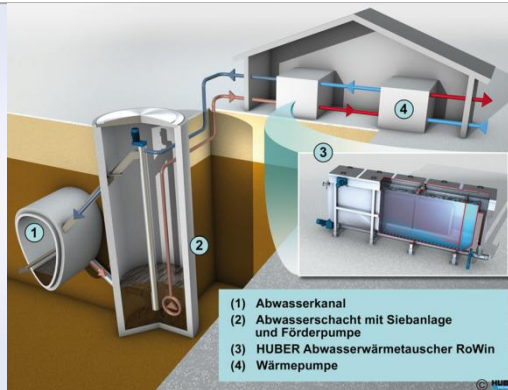
Heat exchanger systems for wastewater



In-pipe solution – for open pits



Gutter heat exchanger at the bottom of the sewer



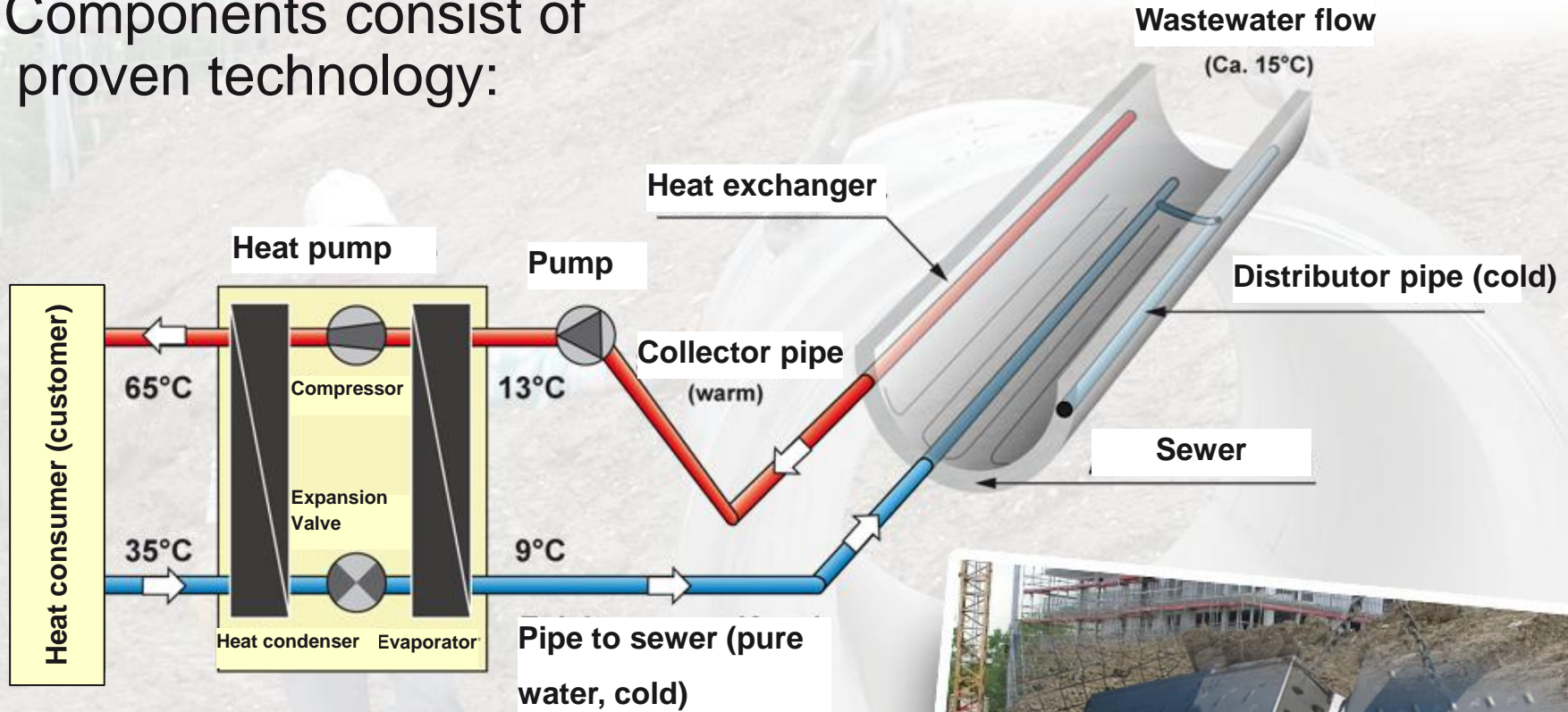
Bypass method - use of a branch current



Use of treated wastewater - final clarification

Principles of heat recovery from wastewater

- Components consist of proven technology:



Principles of heat recovery from wastewater

Recommendations according to DWA Advisory Guideline

Combined sewer system with DN \geq 800 mm

Mean dry weather flow at least 15 l/s

No hydraulic impairment of the sewer network

Wastewater temperature at sewer inlet $> 10^{\circ}\text{C}$

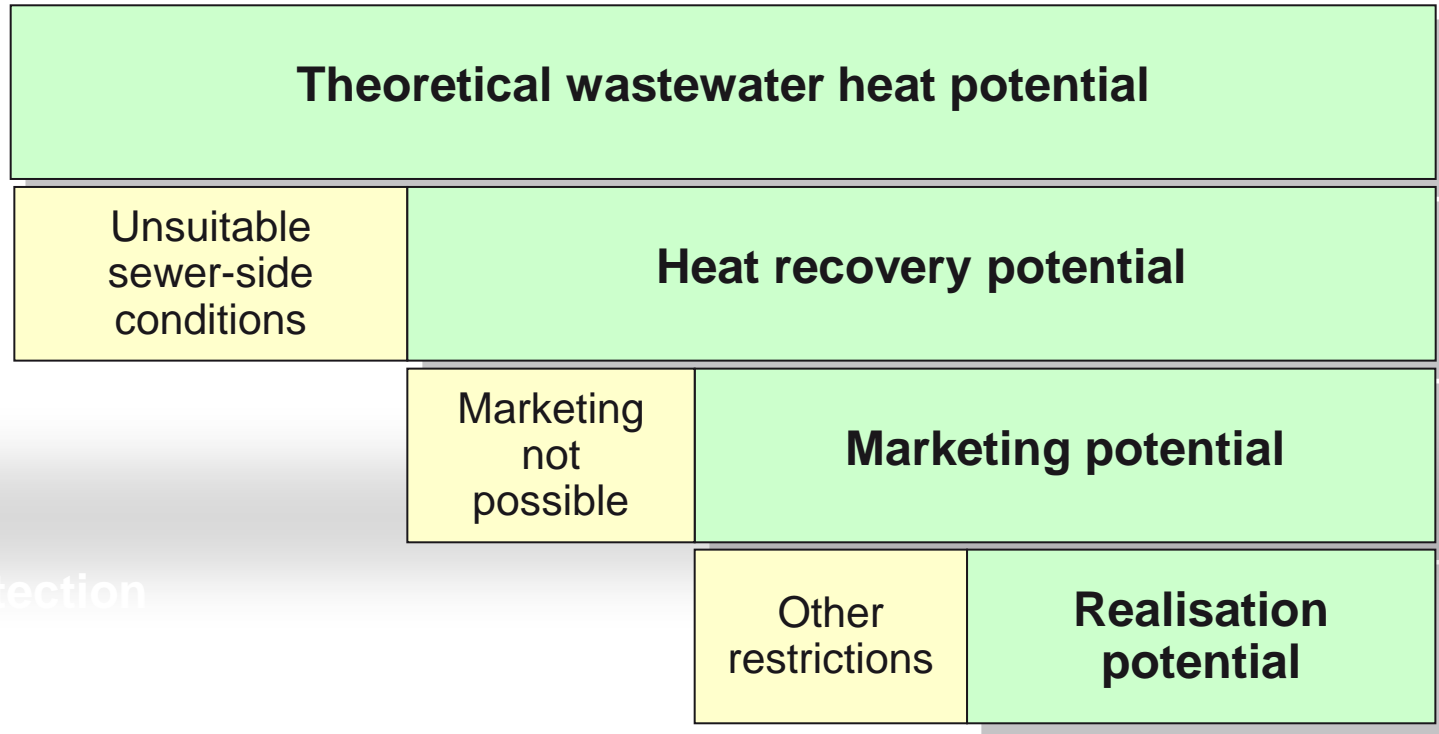
Heating systems with minimum heat requirement of 150 kW

Profitability rises with heat pumps > 100 kW



Potentials and site identification

Potentials of heat recovery from wastewater

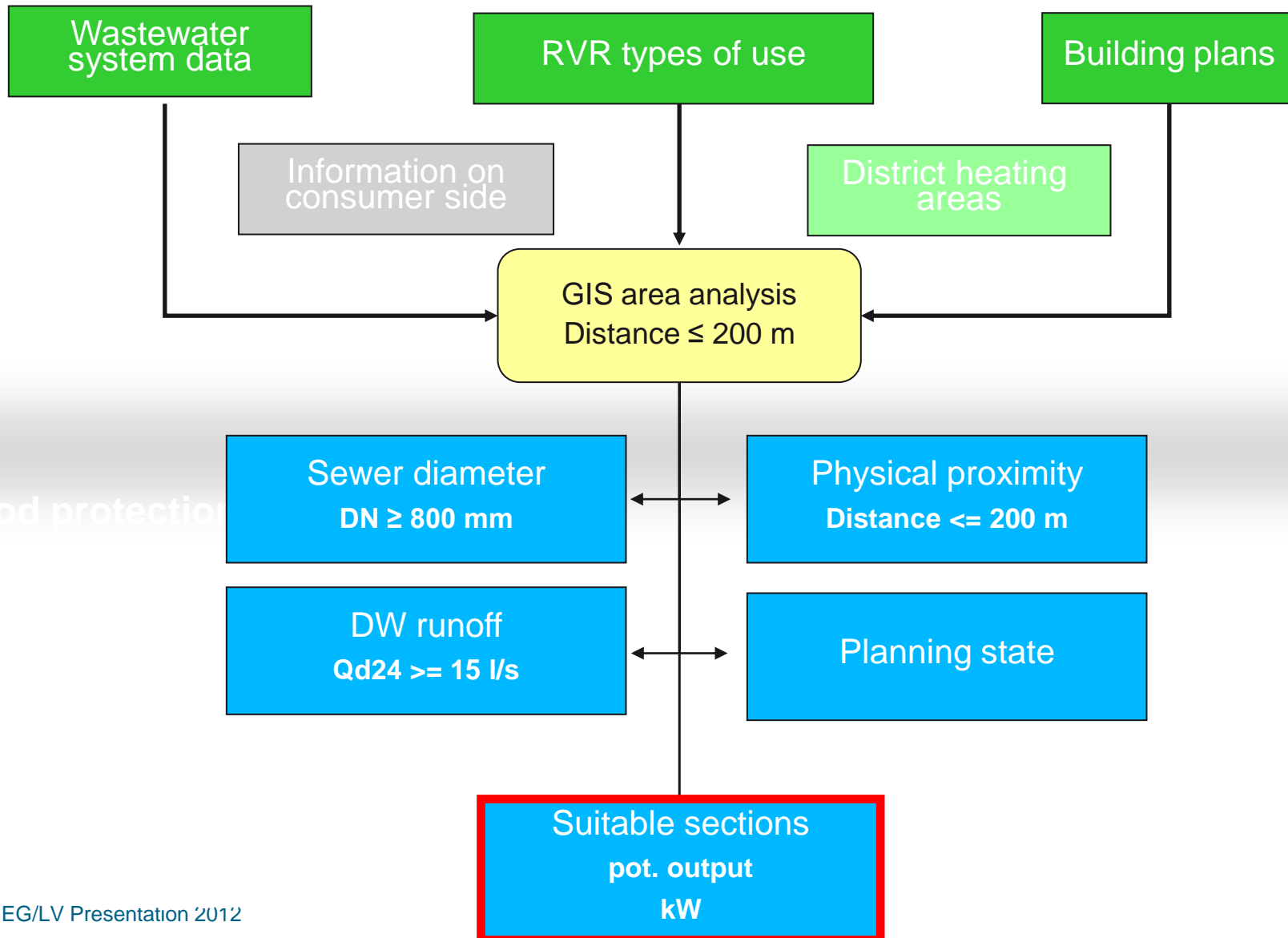


Germany: realisable potential about 5% of the building stock

Emscher region: realisation potential of around 20 km sewers or 100 systems of a magnitude of 500 kW

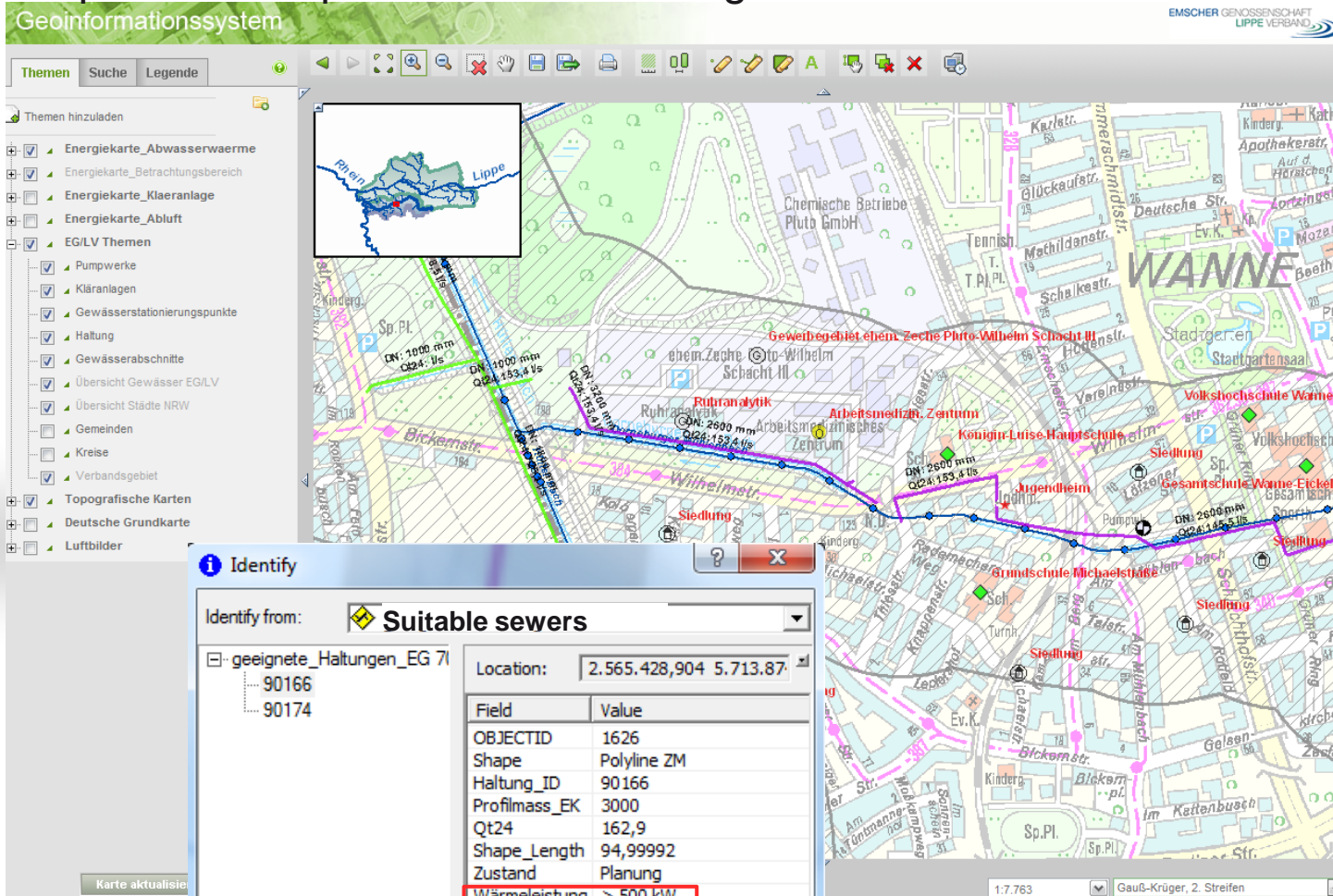
Procedure for site identification

How do I get from the theoretical potentials to concrete sites?



Procedure for site identification

Heat potential map for the Emscher region



potential heat extraction

Promoted by:

Ministry for Climate Protection, Environ
Agriculture, Nature Conservation
and Consumer Protection
of the State of North Rhine-Westphalia



Implementation of the system

Step-by-step procedure recommended

