IWA World Water Congress and Exhibition

International Water Association

VIENNA 2008

Anton Peter-Fröhlich

Experiences with Sanitation Concepts for Separate Discharge and Treatment of Grey-, Brown- and Yellowwater based on an EU Demonstration Project

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Jens Meinhold	**(Veolia Water)**

Cooperation* mit *OtterWasser GmbH, TUHH, TUB und HUB

Duration (1 Jan 2003 – 31 Dec 2006)

With the contribution
of the LIFE financial instrument
of the European Community

Content

- Objectives
- Motivation
- Material and Methods
- Results
- Co-operations
- Conclusions

Objectives

The *new sanitation concepts* should be relevant solutions for:

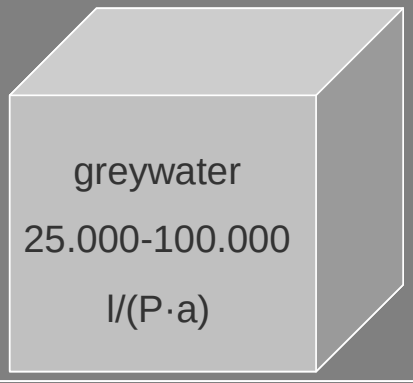
- remote areas, where the connection to a central system wouldn't be technically or economically interesting
- rapidly growing conurbation's in developing countries
- countries with scarce water resources
- a sustainable development with the recycling of nutrients and water

Motivation

- world wide water and food shortage
- limited phosphorus reserves
- kind of wastewater composition

Motivation

Quality of different wastewater streams



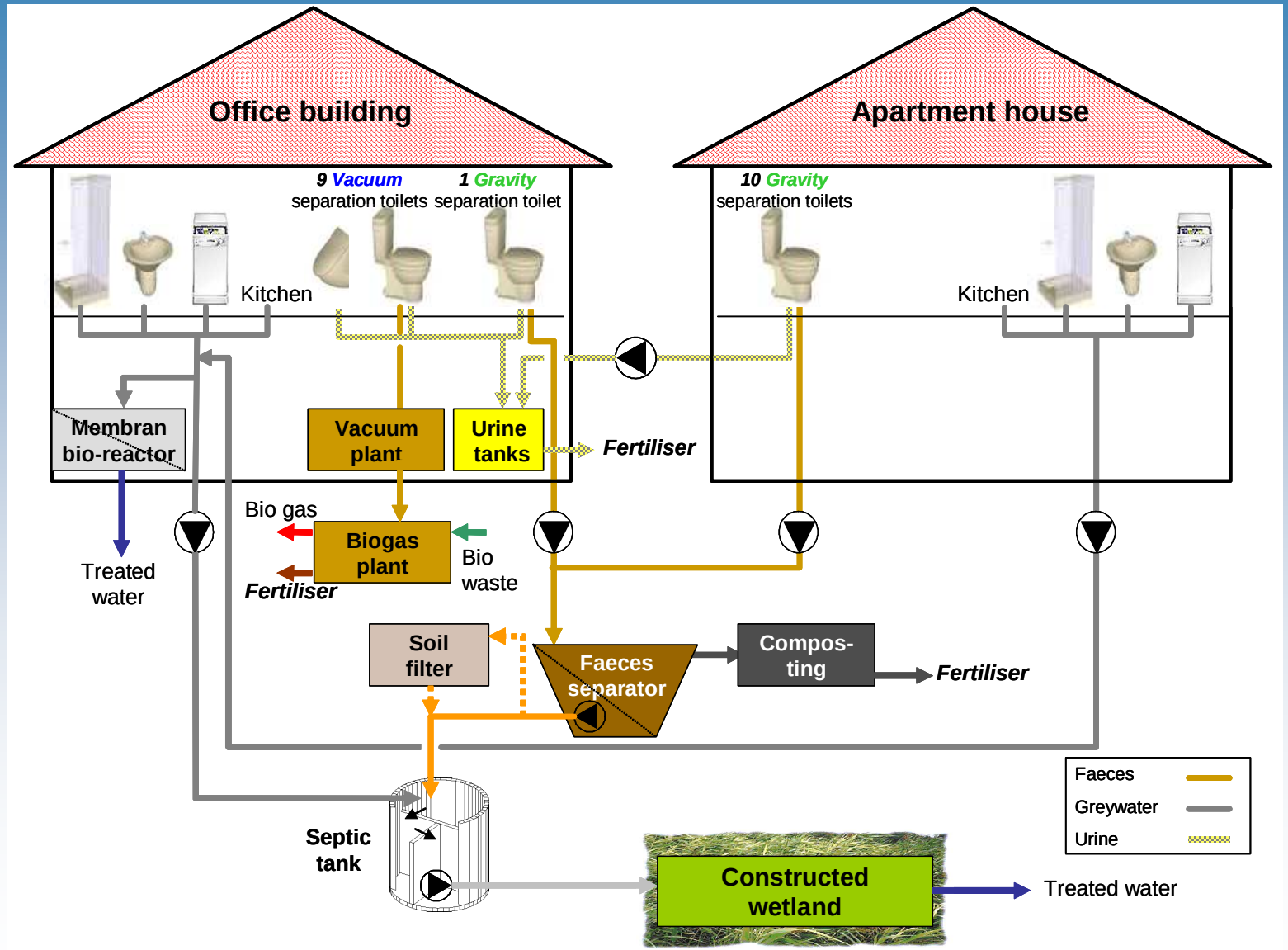
specific flux →	greywater 25.000-100.000 l/(P·a)	urine ≈ 500 l/(P·a)	faeces ≈ 50 l/(P·a)
N-load	≈ 14 g/(P·d)	≈ 3 %	≈ 87 %	≈ 10 %
P-load	≈ 2 g/(P·d)	≈ 10 %	≈ 50 %	≈ 40 %
K-load	≈ 5 g/(P·d)	≈ 34 %	≈ 54 %	≈ 12 %
COD-load	≈ 85 g/(P·d)	≈ 41 %	≈ 12 %	≈ 47 %
pathogenic germs		++	+	+++++++
residual pharmaceuticals		+	+++++++	++
		↓ treatment ↓ reuse / water cycle	↓ production of fertiliser ferment / compost ↓ nutrient cycle / energy recovery	

source: Otterpohl (wwt awt 2/2000, modified)

Material and Methods

Vacuum Separation Toilets

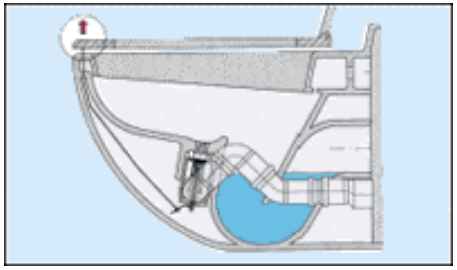
Gravity Separation Toilets

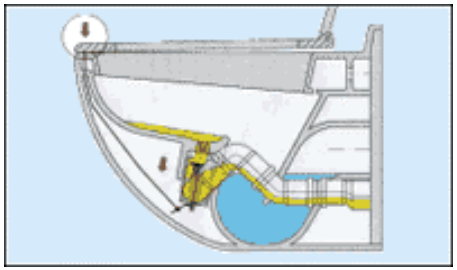


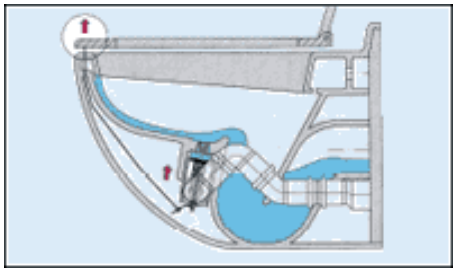
Material and Methods

Roediger ***Gravity*** ***Separation Toilet***

waterles
yellow-water (urine)
collection







6 – 10 L/flush

Material and Methods

Roediger *Vacuum* *Separation Toilet* at WWTP Stahnsdorf

0.7 – 2 L/flush

Material and Methods

Vacuum plant for *Vacuum* separation toilets at WWTP Stahnsdorf

Material and Methods

Filter bags for brownwater dewatering

Material and Methods

Biogas plant

Material and Methods

Constructed wetland at WWTP Stahnsdorf

Material and Methods

Office building WWTP Stahnsdorf

Material and Methods

Apartment house WWTP Stahnsdorf

Results

Infl.- and effl. values (mean values) of the *faeces separator*

parameter	unit	brounwater from apartment house 29.6.2005 - 1.7.2006 (V7)		
		infl.	effl.	stored [%]
flow	L/d	945	943	
SS	mg/L	1.151	246	79
COD	mg0_2/L	2.036	1.023	50
N-total	mgN/L	174	141	19
NH_4-N	mgN/L	106	110	-4
P-total	mgP/L	31	16	50

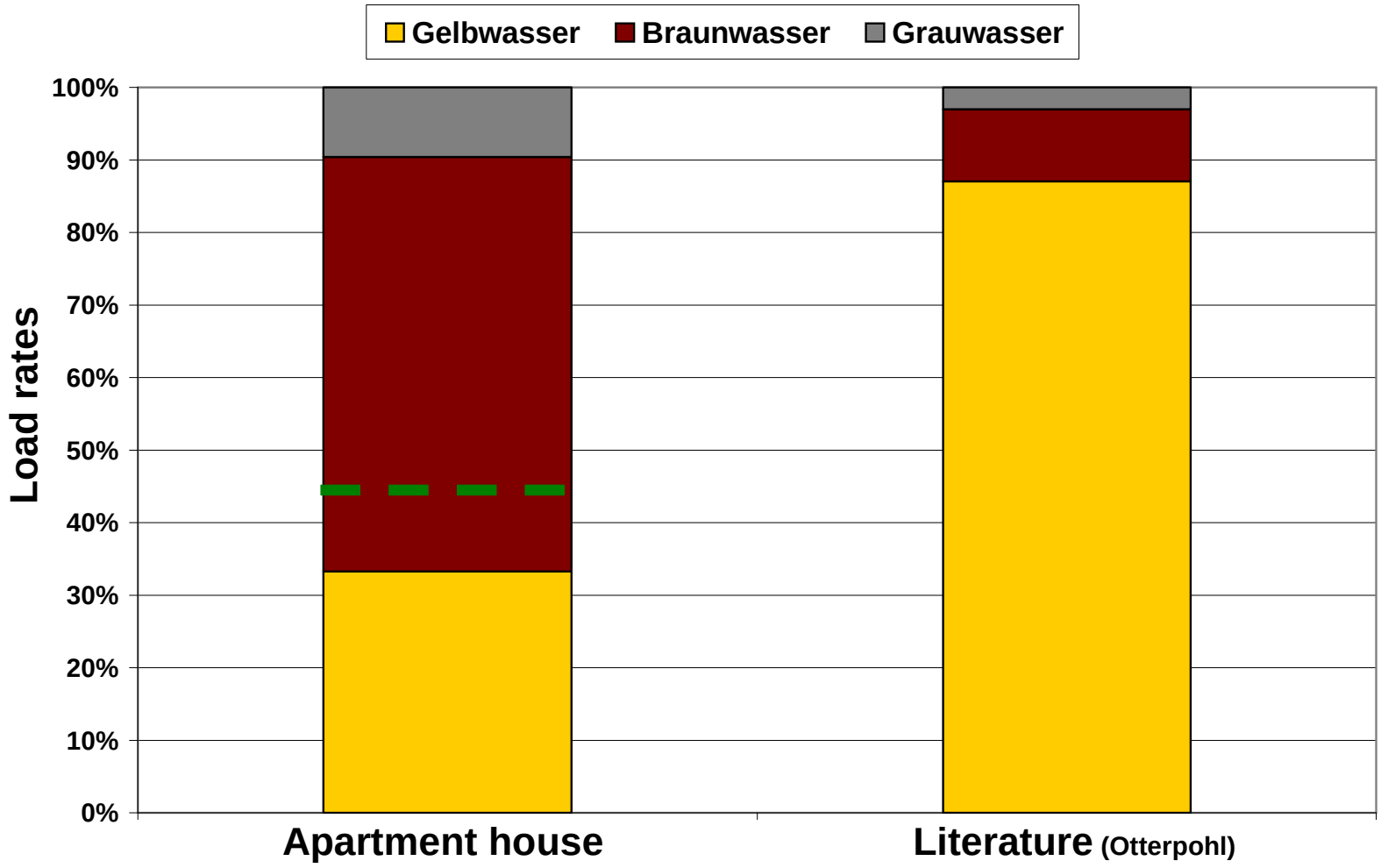
Results

Infl.- and effl. values (mean values) of the *constructed wetland*

parameter	unit	greywater from office building and apartment house			
		with faecal filtrat		**without** faecal filtrate	
		29.6.2005 - 1.7.2006		1.9. - 16.11.2006	
		infl.	effl.	infl.	effl.
flow	L/d	5.191		4.334	
COD	$mg0_2/L$	402	27,6	318	18,6
NH_4-N	mgN/L	20,4	2,6	5,8	0,1
NO_3-N	mgN/L	1,1	13,2	0,3	2,7
P-total	mgP/L	6,7	1,7	4,7	0,5

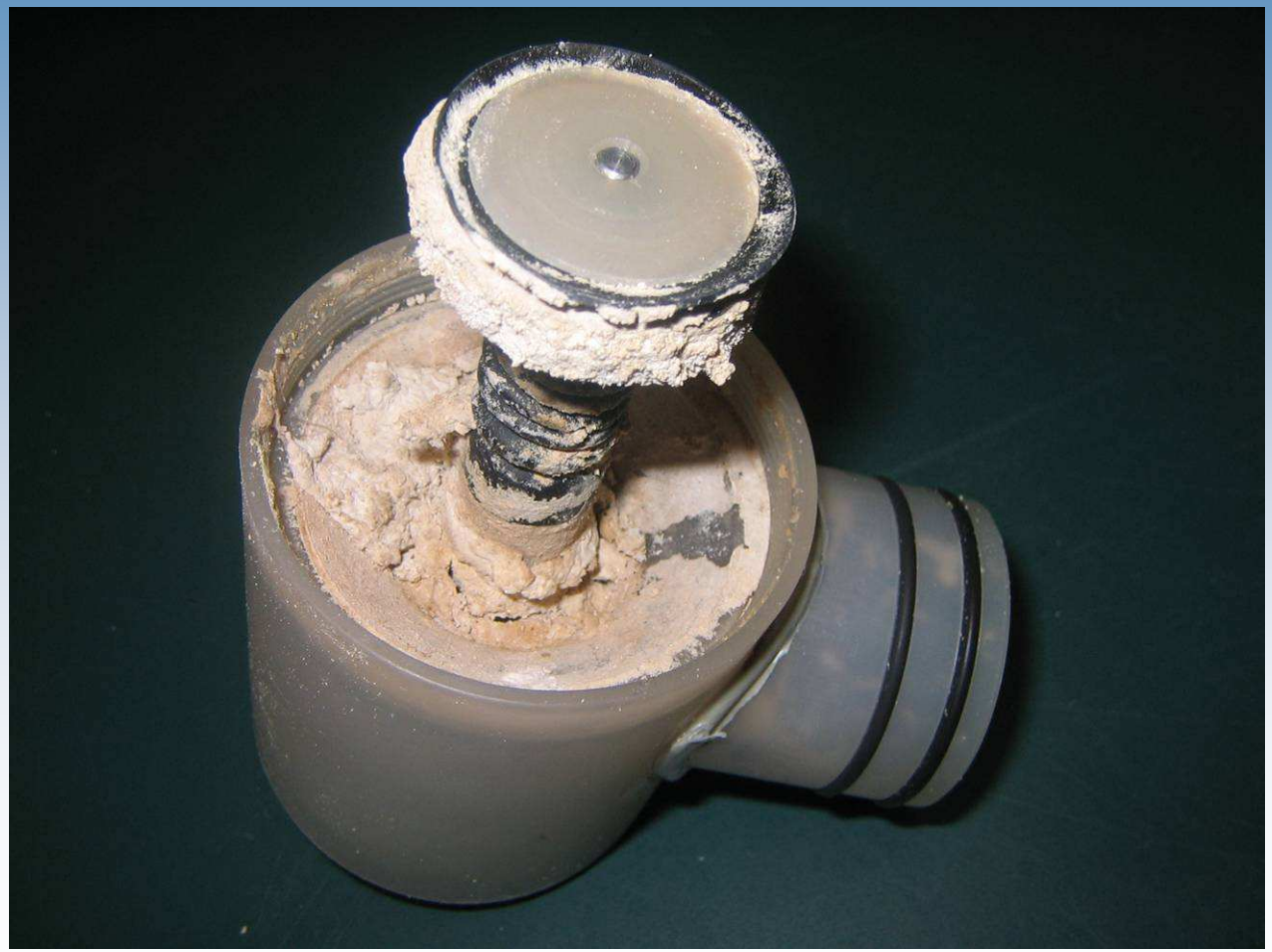
Results

Comparison of load rates of N-total with literature values (apartment house)



Results

Incrustation of the valve from urine effluent of a gravity separation toilet from apartment house



Co-operations

- TUHH (Urine treatment)
- HUB (Fertiliser usage)
- TUB (Life-Cycle-Assessment)
- Otterwasser GmbH
  (consultation, cost comparison)

Co-operation

Urine treatment (TUHH)

- **Steam stripping**
- **Vacuum evaporation**
- **Combinations**

a) ***Improvement of resource production***

- MAP-precipitation

- Crystallisation

b) ***Elimination of pharmaceutical residues***

- UVC-radiation

- Ozone-treatment

- Crystallisation

Co-operation

Urine treatment (TUHH) - Results

- **Steam stripping**

  Product: 12% ammonia water (25 L / m^3 urine)

- **Vacuum evaporation**

  Product: 50-fold concentration (20 L concentrate / m^3 urine)

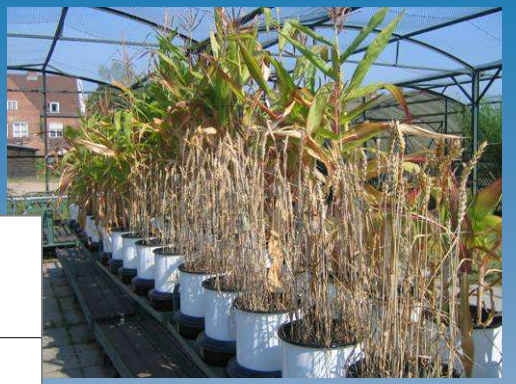
- **Elimination of pharmaceutical residues**

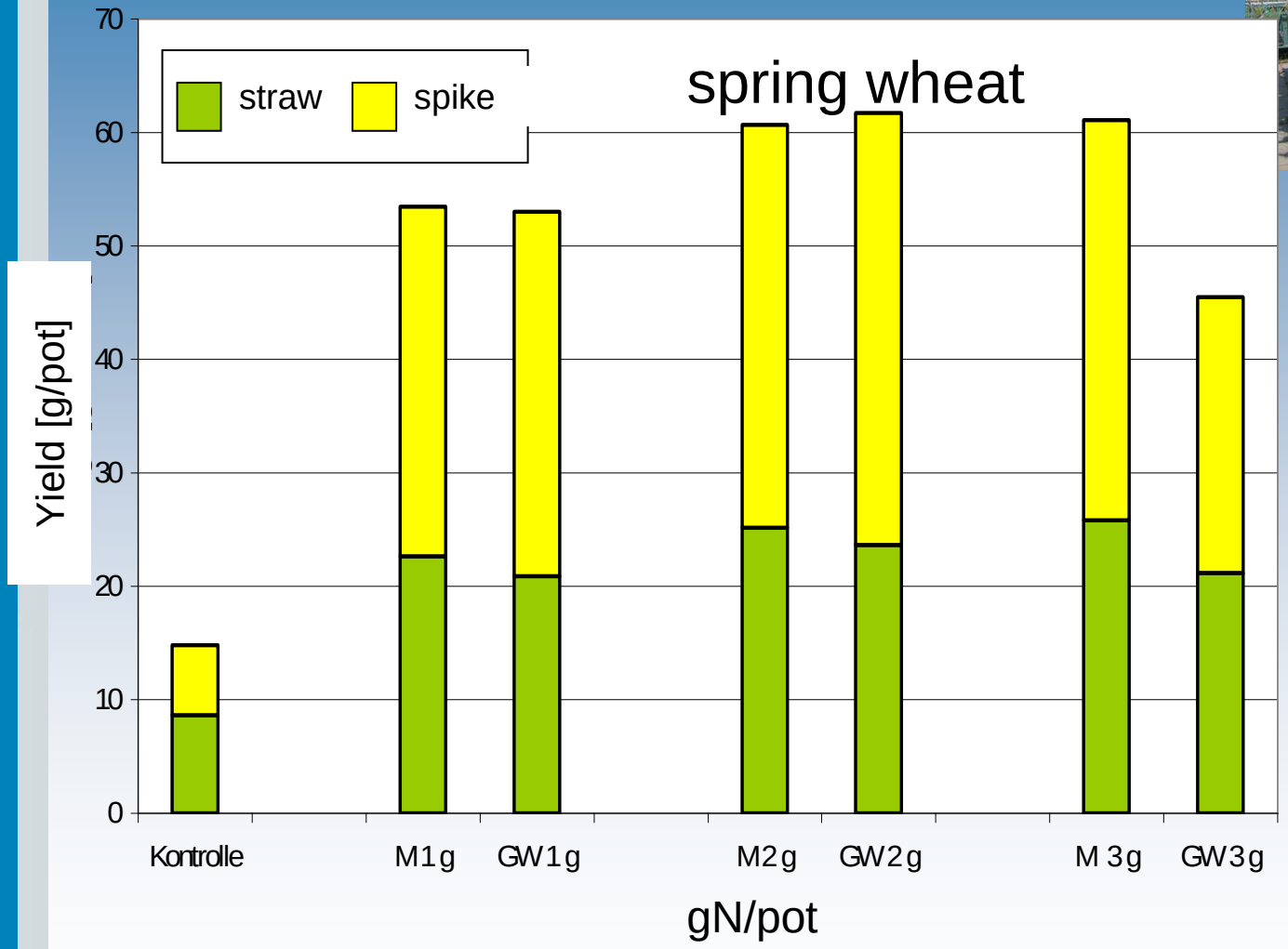
  With ozone-treatment all analysed pharmaceuticals could be removed

- **Steam stripping + MAP precipitation favourable**

Co-operation

Fertiliser usage (HUB)





Urin Berlin and Brandenburg: 40 % N and 75 % P of Mineral fertiliser for Brandenburg!

Farmers prefer urine more than digested sludge!

Co-operation

Life-Cycle-Assessment (TUB)

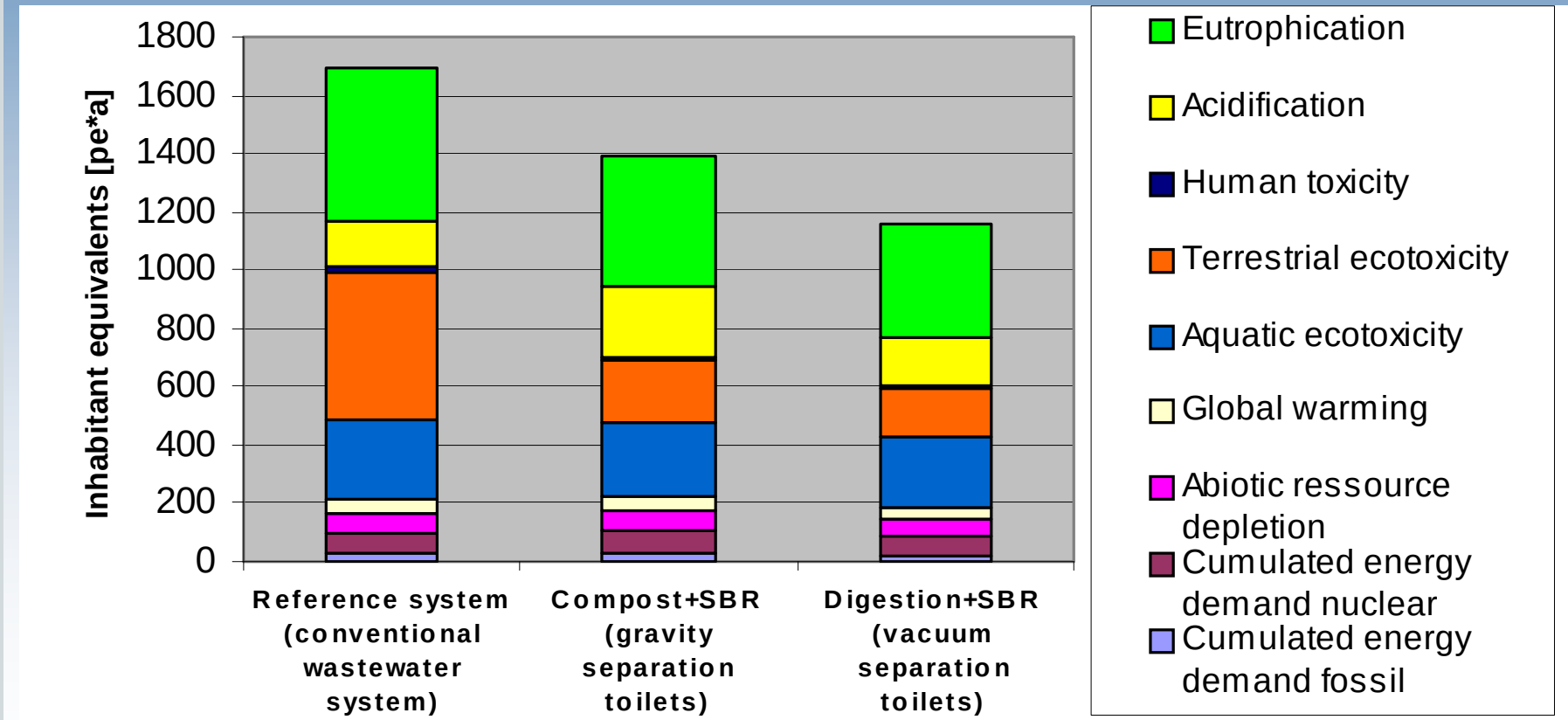
- **settlement in Berlin: 5,000 inhabit., 1,000 build.**

Comparison of

- ***conventional Sanitation system* with**
- **new Sanitation concepts**
  - **a) *Gravity*-Separation toilets**
  - **b) *Vacuum*-Separation toilets**

Co-operation
Life-Cycle-Assessment (TUB)

Normalised eco profiles
as inhabitant equivalents (ecological damage)



Co-operation

Cost comparison (Otterwasser GmbH)

- settlement in Berlin: 5,000 inhabit., 1,000 build.
- period of 50 years
- total project costs (dynamic prime costs)

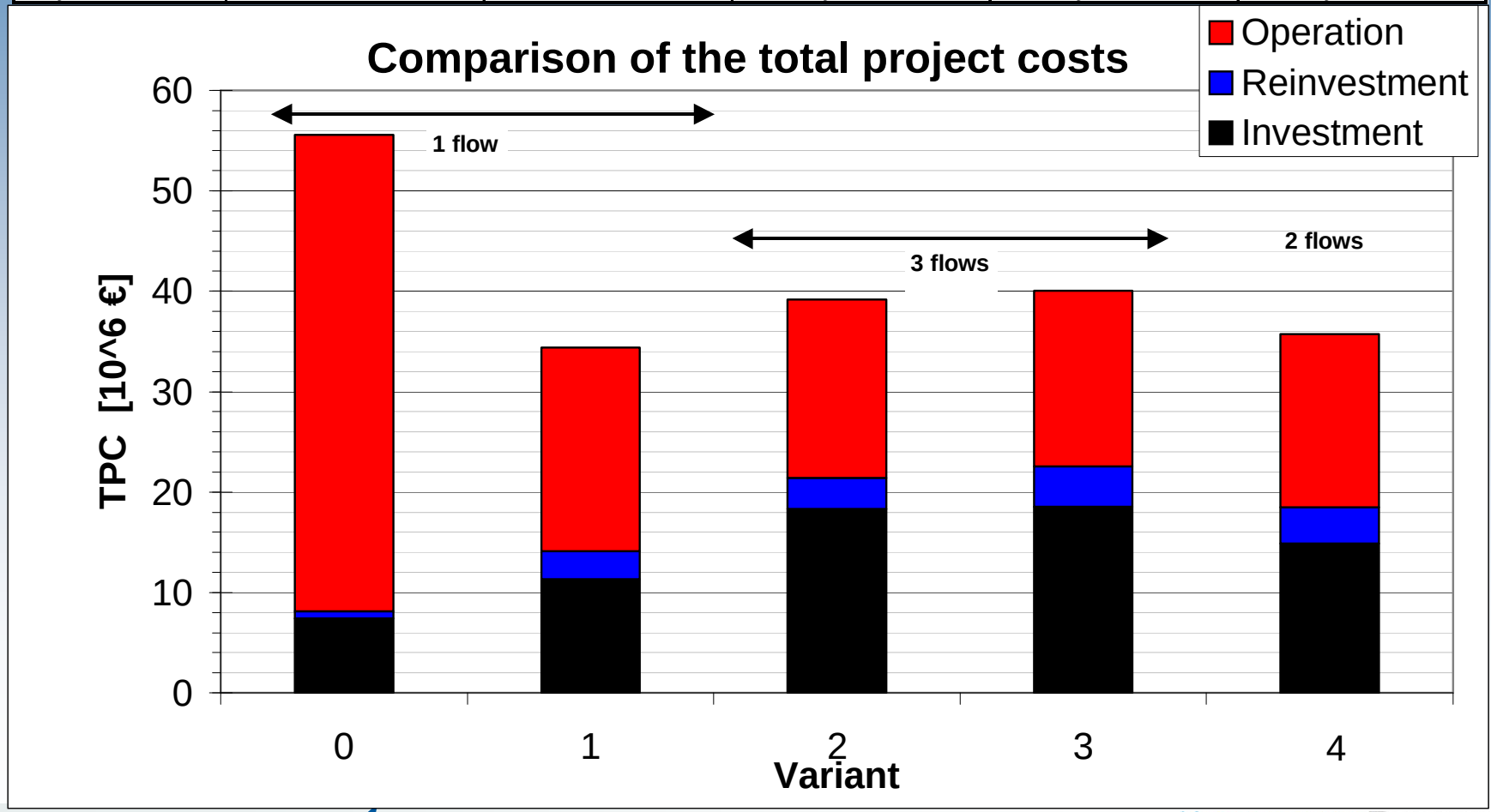
compared:

- *conventional Sanitation system* with
- new Sanitation concepts
  - a) *Gravity*-Separation toilets
  - b) *Vacuum*-Separation toilets
  - c) additional variants

Co-operation

Cost comparison (Otterwasser GmbH)

Variant	0	1	2	3	4
Yellowwater	Wastewater, Gravity sewer, SBR, Schwante	Wastewater, Gravity sewer, SBR, Berlin (BWB)	Gravity and force main sewer, SBR	Gravity and force main sewer, SBR	Vaccuum sewer, Biogas
Brownwater			Gravity and force main sewer, Compost	Vaccuum sewer, Biogas	
Greywater			Gravity sewer, SBR	Gravity sewer, SBR	Gravity sewer, SBR



Conclusions

- results of the SCST project show in general that a potential for development exists especially for sanitary facilities
- since the issues water reuse and nutrient recycling as well energy are very significant, increasingly further developments are necessary for a broader application of alternative sanitation concepts
- Activities increasing world-wide (IWA, DWA, etc.)
- Final Report available on www.kompetenz-wasser.de\SCST.22.0.html