INTEGRATED RESOURCE MANAGEMENT IN ASIAN CITIES

LUNCHEON TALK DURING

THE WORLD WATER DAY CELEBRATION, 2014

Bangkok, Friday 21 March 2014, 12:30-14:00 hours

Foyer, United Nations Conference Centre

german cooperation
DEUTSCHE ZUSAMMENARBEIT

Implemented by
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NEXUS

Integrated Resource Management in Asian Cities:

the Urban NEXUS

(Water / Energy / Food Security / Land Use)

Participating countries:

- **China**
- **Indonesia**
- **Mongolia**
- **Philippines**
- **Thailand**
- **Vietnam**

Participating cities:

- Ba‘nan, 920.000
- Rizaho, 2.880.000
- Weifang, 9.000.000
- Yogyakarta, 388.000
- Ulaanbaatar, 1.200.000
- Naga City, 180.000
- Santa Rosa, 330.000
- Chiang Mai, 150.000
- Korat, 180.000
- Da Nang, 900.000

Integrated Resource Management in Asian Cities: the urban Nexus (water, energy, food/land use)

- Time frame: 2013 - 2015
- Political Partner: UN ESCAP (Bangkok, Thailand)
- Implementation Partner: International Council for Local Environmental Initiatives (ICLEI SEA)
- Financed by BMZ (German Federal Ministry for Economic Cooperation & Development)

Approach:

- Introduction of innovative engineering technologies in the area of waste water and solid waste management, generation of energy, link to (urban) agriculture, EE in/of buildings
- Holistic/integrated urban planning/breaking open of „silo“ thinking (creation of Nexus Task Forces in cities)
- Multi level approach (micro, meso, macro, supraregional)
- Private sector, civil sector, state/communal
- Grounded/concrete demonstration projects/PFS/FS/scaling up

NEXUS Organisational Structure

Supra-regional Level
ASEAN, CDIA, CITYNET, Donors

National Level
Mongolia:
Ministry of Environment & Green Development
Ministry of Energy
Ministry of Construction & Urban Development
Philippines:
Department of Environment & National Resources
Department of Energy
Department of Public Works & Highways
Thailand:
Ministry of Natural Resources & Environment
China:
Ministry of Housing, Urban - Rural Development
Indonesia:
Ministry of National Development & Planning
Vietnam:
Ministry of Natural Resources & Environment
Ministry of Construction

National meso Level
Associations of Municipalities, Utilities, Training Inst.

BMZ
Finance/political directives

UN ESCAP
Political Partner

GIZ NEXUS

ICLEI-SEA
Implementation Partner

Rizhao NEXUS Taskforce	Weifang NEXUS Taskforce	Ba'nan NEXUS Taskforce	Ulaanbaatar NEXUS Taskforce	Yogyakarta NEXUS Taskforce	Santa Rosa NEXUS Taskforce	Naga City NEXUS Taskforce	Da Nang NEXUS Taskforce	Korat NEXUS Taskforce	Chiang Mai NEXUS Taskforce
Industrial waste water treatment ("Asia Symbol")	Eco City Binhaie	Erosion Landslides	Thermo-technical rehabilitation	Waste water to energy (biogas)	Vacuum waste water collection	Waste water to energy (biogas)	Vacuum waste water collection	Waste water management	Waste water management
		Waste water treatment	Vacuum waste water collection		Urban agriculture	Energy efficient LCH	Waste water to energy (biogas)	Solid waste management	
			Waste water to energy		Energy efficient LCH		Urban agriculture	Energy efficient pumps	

Sustainable water solutions

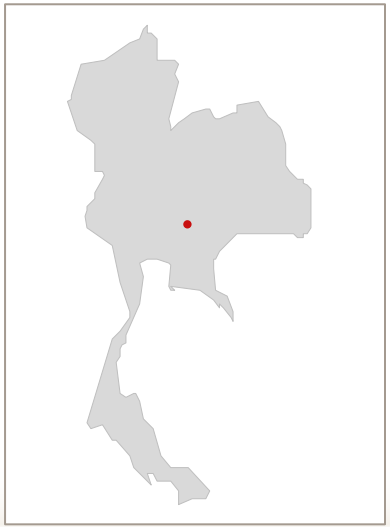
Korat (Nakhon Ratchasima), Thailand

Rationale

High electricity costs for water and waste water pumps (up to USD 50.000 per month)

Solution:

- Implementation of System Efficiency Service (SES) of water & waste water pumps;
- Comparison of energy saving potential if properly operated and maintained
- Comparison of energy saving potential if replaced by modern pumps representing state-of-the-art or overhaul
- Cost calculation for replacement or overhauling (cost recovery period)



Sustainable water solutions

Korat, Thailand, system efficiency survey of clean water pumps

Dutypoint according to pump's nameplate

Pump 1-6: Q 600 m3/hr, H 65 m., rated 292 A

Pump 7-9: Q 500 m3/hr, H 67 m., rated 288 A

3.Pump operating condition check at site.

Table 3-1 : Shown data from pump condition check at site.

Pump Item	Flow (Q) Data	Flow (Q) Actual	Discharge Pressure (bar)	Suction Pressure (bar)	ΔP (bar)	Operating temp(°C)	Density (Kg/m3)	TDH (m)	Current (Amp)			Voltage (Volt)			Power
	m^3/h	m^3/h	P1	P2		T	ρ	H	R	S	T	R	S	T	kW
1	600.00	600.00	4.10	-0.400	4.50	25.00	997.0	46.01	249	250	254	401.80	400.70	398.10	149
2	600.00	600.00	5.60	-0.400	6.00	25.00	997.0	61.35	285	286	289	400.30	398.90	396.30	161
3	600.00	536.00	6.30	-0.400	6.70	25.00	997.0	68.50	286	286	291	398.50	397.30	394.80	170
4	600.00	820.00	3.80	-0.50	4.30	25.00	997.0	43.96	309	326	329	400.40	399.30	396.30	184
5	600.00	600.00	6.10	-0.35	6.45	25.00	997.0	65.95	279	297	274	401.00	400.60	397.00	155
6	600.00	600.00	6.20	-0.30	6.50	25.00	997.0	66.46	285	296	289	401.40	400.40	396.90	170
7	500.00	500.00	1.00	-0.20	1.20	25.00	997.0	12.27	226	239	229	397.00	393.80	390.90	138
8	500.00	500.00	1.70	-0.20	1.90	25.00	997.0	19.43	234	246	235	393.60	390.30	387.50	140
9	500.00	500.00	6.90	-0.15	7.05	25.00	997.0	72.08	306	287	281	387.50	385.10	388.30	167

Remark: The customer did not allow to adjust flow rate of Pump no.3,4

Mean that the selected data are un acceptable reference from motor and pump nameplate.

Pump nameplate data.

Calculation information.

Actual data from pump condition check on site.

Sustainable water solutions

Korat, Thailand, system efficiency survey of clean water pumps

Table 4-1:Shown energy saving with compared of old pump and new pump.

On nomal operating condition.					
				Existing pump (no 9)	**New Pump**
Operating house per year	T_B	h/y		**8,760.00**	
Flow rate	Q	m^3/h		**500**	**500**
Head	H	m		**72.08**	**67.00**
Power consumption	P_{auf}	kW		**167**	**120.8**
Flow per year	Q_J	m^3/y	QJ=Q*TB	**4,380,000.00**	**4,380,000.00**
Specfic energy requierement	E_s	kWh/m^3	ES=Pauf/Q	**0.334**	**0.242**
Energy requirement per year	E_{J2}	kWh/y	EJ=QJ*ES	**1,462,920.00**	**1,058,208.00**
Saving energy per year	Ee_2	kWh/y	$Ee_{2=}EJ_{Old\ pump}$-$EJ_{New\ pump}$		
Saving per year		Baht/y			

***H 67 m. according to pump nameplate**

Return on Investment Period for Pump No.9				
Exisiting Pump No.9		uses	1.462.920	kWh/y
New Pump		uses	1.058.208	kWh/y
		difference	404.712	kWh/y
Electricity charges at			3	Baht/Kwh
Total Energy saved per year			1.214.136	Baht/y
Total Energy saved per month			101.178	Baht/month
Cost of New Pump			380.800	Baht
Return on Investment period			**3,76**	months

Sustainable water solutions

Korat (Nakhon Ratchasima), Thailand

Further steps in Korat

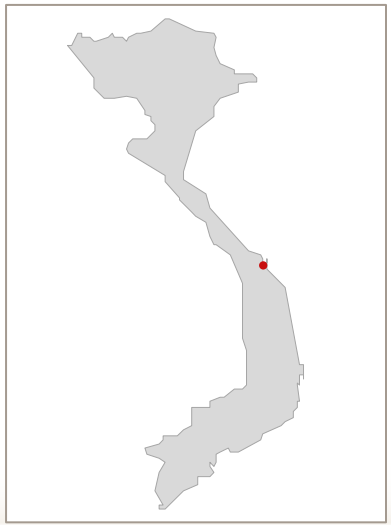
- Implementation of training of water & waste water pumps operating staff
- Introduction of log book (checklist) for regular maintenance & repair work
- Make clear relevance of continuous maintenance and repair of pumps
- Analysis of treated waste water (apt for agriculture?)
- Analysis of problems of biogas reactor (managerial problems and technical problems with regard to separation of organic waste from plastic)
- Elaboration of overall concept for solution of problems (long term perspective)

Sustainable waste water solutions

Da Nang, Vietnam, vacuum water water collection

Rationale

- Waste water treatment plants (4) do only receive diluted waste water, no faeces
- Only grey water from kitchens and bathrooms are connected to the sewer lines
- Toilets are often not at all connected or only the effluent
- River and ground water has started to be contaminated (coli bacteria)
- World Bank has approved a waste water rehabilitation project Including pilot solutions for waste water collection and treatment



Sustainable waste water solutions

Da Nang, Vietnam, vacuum waste water collection

Da Nang, Eastern coastal area, household survey

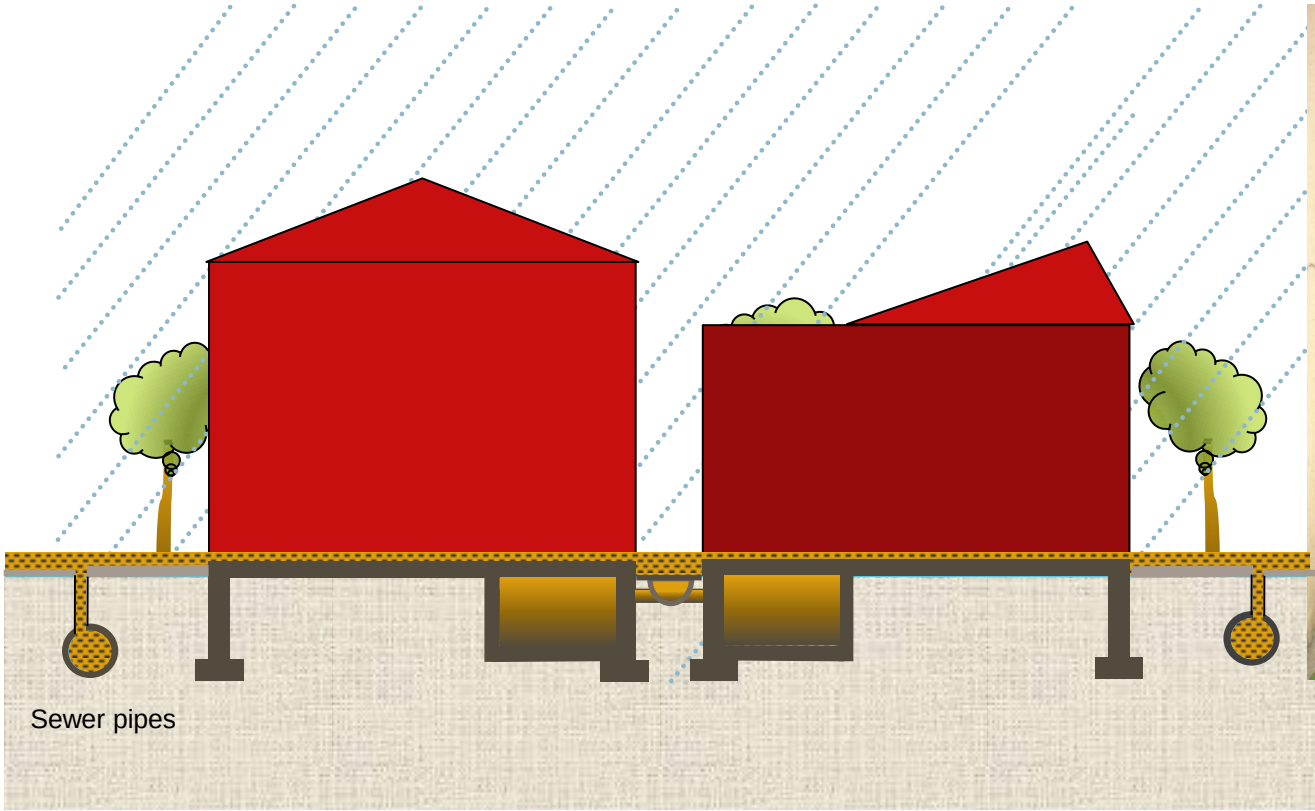
16/3/2014

Total number of households	110									
Housholds interviewed	79		72	%	Sanitary ware in the Households					
Interview denied	8		7	%	Toilets					
Until now not interviewed	23		21	%	yes	79		100	%	
					no	0		0	%	
Household owner lives in the house	75		95	%	Shower					
House is rented	4		5	%	yes	74		94	%	
					no	5		6	%	
House has a septic tank	78		99	%	Bathtub					
House is directly connected	1		1	%	yes	13		16	%	
					no	65		82	%	
Septic tank is located under the					Urinal					
bathroom	70		89	%	yes	36		46	%	
kitchen	7		9	%	no	43		54	%	
don't know	1		1	%	Bidet					
					yes	77		97	%	
House connected to the sewer					no	2		3	%	
yes	56		71	%	Kitchen sink					
no	23		29	%	yes	77		97	%	
					no	2		3	%	
Household has water meter					Washing maschine					
yes	79		100	%	yes	61		77	%	
no	0		0	%	no	18		23	%	

Average of monthly payment for water	
per household in VND	95.012,66

Sustainable waste water solutions

Da Nang, Vietnam, vacuum waste water collection



Sustainable waste water solutions

Vacuum sewer collection system

Source: RoeVac® Vacuum Sewer Systems

Why Vacuum Sewerage Systems?

- Vacuum sewerage systems are reducing the impact on the environment and have the lowest carbon footprint of any municipal sewerage system;
- Vacuum sewerage systems are collecting waste-water by vacuum means, thereby minimizing the risks to the Environment

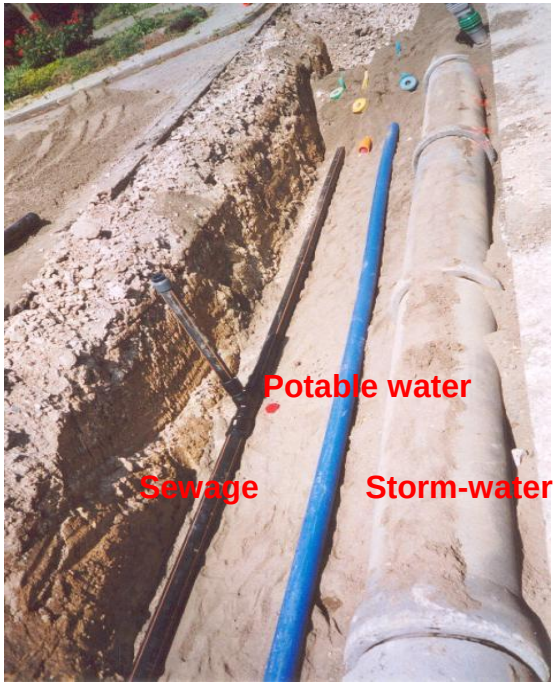
Vacuum system offers important advantages:

- Closed systems with no leakage or smell
- No contamination of groundwater
- No infiltration of external water

Sustainable waste water solutions

Vacuum sewer collection system

Source: RoeVac® Vacuum Sewer Systems



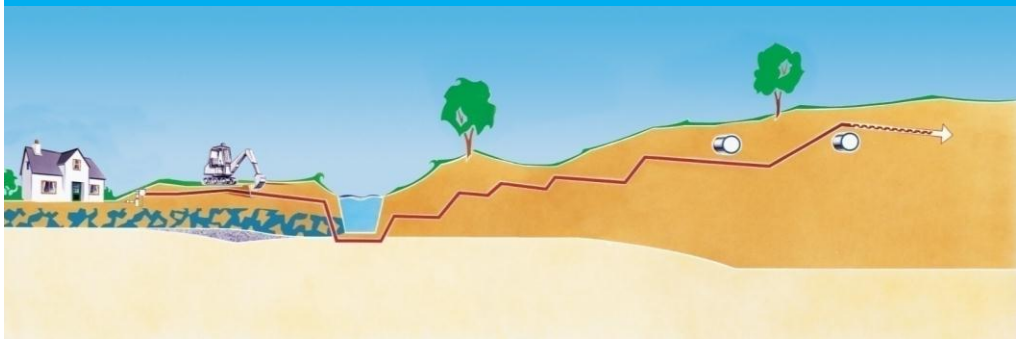
- Sewer and water pipes can be laid in a common trench

Sustainable waste water solutions

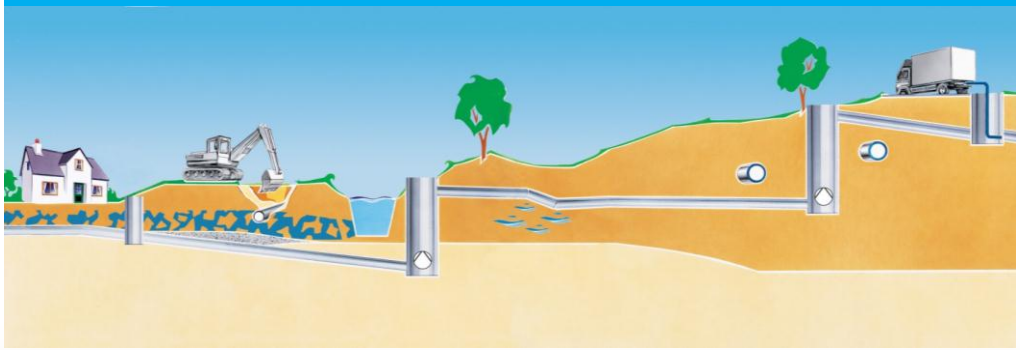
Vacuum sewer collection system

Source: RoeVac® Vacuum Sewer Systems

Vacuum sewer system



Gravity sewer system



Advantages of vacuum systems for investors and operators:

- Lightweight small diam. sewer pipes, ease of installation;
- Shallow and small trenches;
- No manholes, no lift stations;
- Only one central vacuum station instead of many lift stations;
- Speed of construction is greatly increased;
- Greatly reduced construction costs;
- Flexible pipeline construction;
- Easy to lay pipelines around obstacles

Sustainable waste water solutions

Vacuum sewerage system – kitchen waste

Kitchen bio waste

- Kitchen bio waste is processed alongside domestic wastewater
- The kitchen is equipped with an appliance for shredding kitchen waste.
- Installed under the kitchen sink, adds shredded bio waste to the wastewater outflow

Main advantage of treating wastewater and kitchen waste together:

- no hygienic problems or odours from waste containers
- the organic kitchen waste substantially increases the biogas yield of the wastewater treatment plant
- Higher volume of biogas

Sustainable waste water solutions

Case study

Source: RoeVac® Vacuum Sewer Systems

Real Case Study Middle East (Fujairah)

Project perfectly suitable for a vacuum sewer system :

- Flat terrain, no natural slopes;
- Sandy, unstable soils;
- Coastal area with high ground water table;
- Long stretched development with a long pipe network;
- Low-density area with 7.500 PE;

Sustainable waste water solutions

Gravity sewerage system – case study

Source: RoeVac® Vacuum Sewer Systems

Gravity Sewer Lines (S&I)	**1.600.000 €**
Manholes (S&I)	**1.000.000 €**
5 pumping stations (civil + M&E) (estimated S&I)	**180.000 €**
Odour control unit for	**50.000 €**
TOTAL approx.	**2.830.000 €**

Vacuum Sewer Lines (S&I)	**500.000 €**
Inspections pipes and division valves (S&I)	**40.000 €**
Collection chambers (S&I) 350 nos. G75 3")	**700.000 €**
Vacuum station (S&I)	**350.000 €**
Customs and transport costs	**90.000 €**
TOTAL approx.	**1.680.000 €**

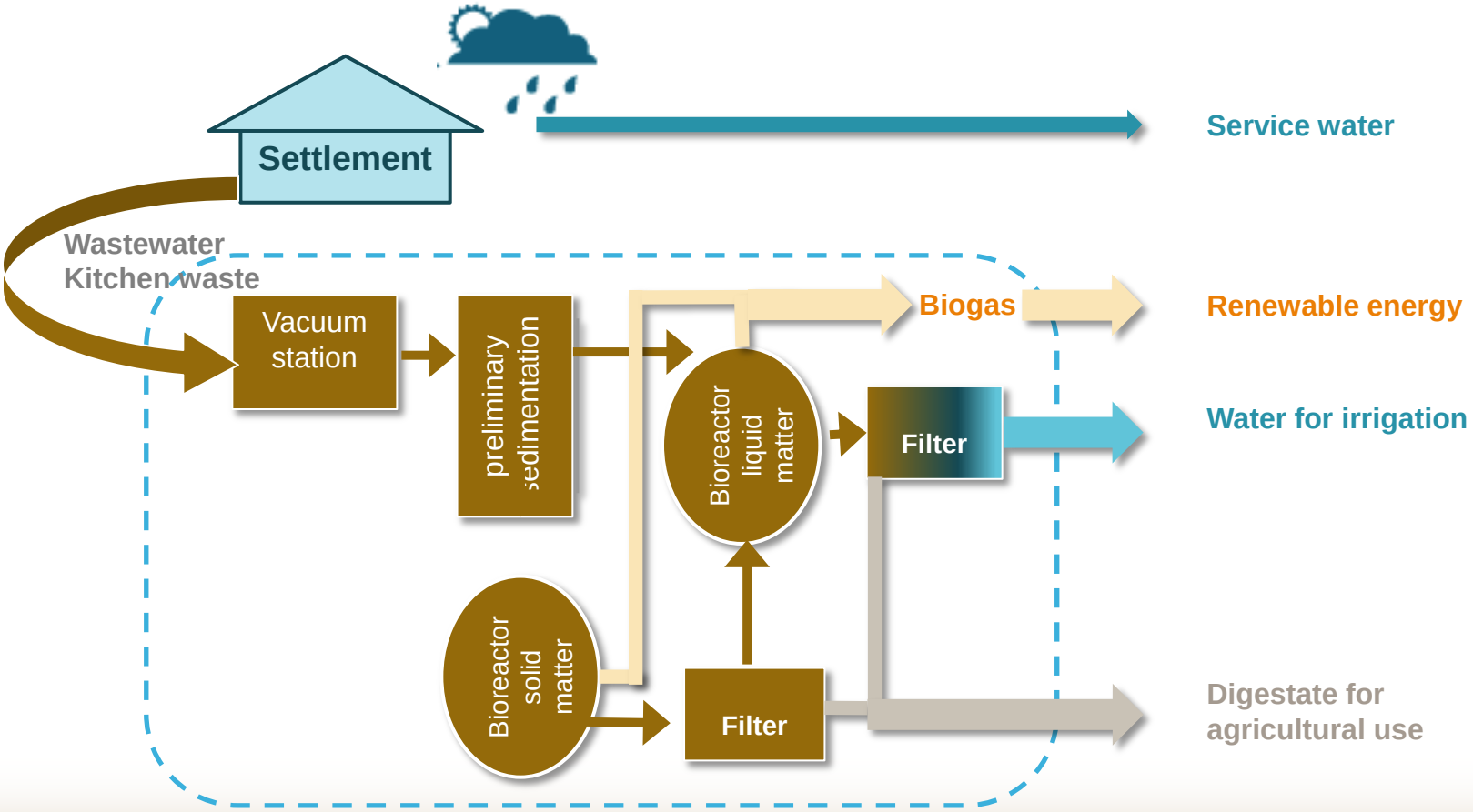
Gravity Total 2.830.000 €
Vacuum Total 1.680.000 €

Cost savings 1.150.000 € or ~ 40 %

S&I: Supply & Installation / Length of the pipe-lines: 18.000 meter

Sustainable waste water solutions

Vacuum sewerage system – biogas production



Sustainable waste water solutions

Vacuum sewerage system – urban agriculture

Vegetables fertilized by the digested black water,
Chentang Village, in Chengdu City, Jiangsu Province of China

- Irrigation of agriculturally used areas
- No further energy intensive treatment necessary
- Nitrogen and phosphate remain in the irrigation water as fertiliser

Urban agriculture in Da Nang, Vietnam

Sustainable waste water solutions

Vacuum sewerage system – soil production

- The remaining sludge after the anaerobic treatment is not contaminated with heavy metal
- The sludge can be used directly for agricultural purposes
- The sludge can be dewatered and grated up to top soil fertiliser

Conditioning of sludge after digestion

Sustainable waste water solutions

Samples for Decentralized Infrastructure solutions

Sustainable waste water solutions

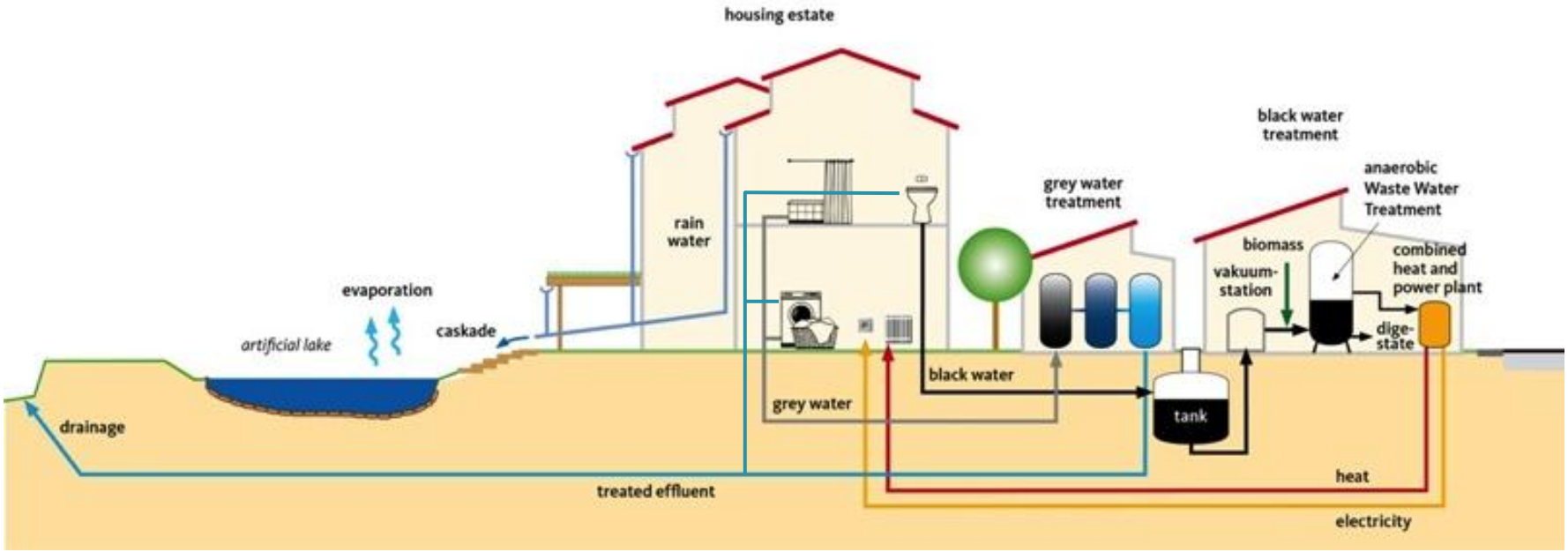
Pilot scale engineering Germany, Hamburg, Jenfelder Au

- Separate collection and treatment of waste water
- Optimal energetic use of energy from waste water
- Heating provision through combined heat and power plant using bio and natural gas
- Thermally insulated buildings with airtight sealed envelop
- Subsidies from banks (KfW) for house owners

Sustainable waste water solutions

Pilot scale engineering Germany, Hamburg, Jenfelder Au

Flow chart



Sustainable waste water solutions

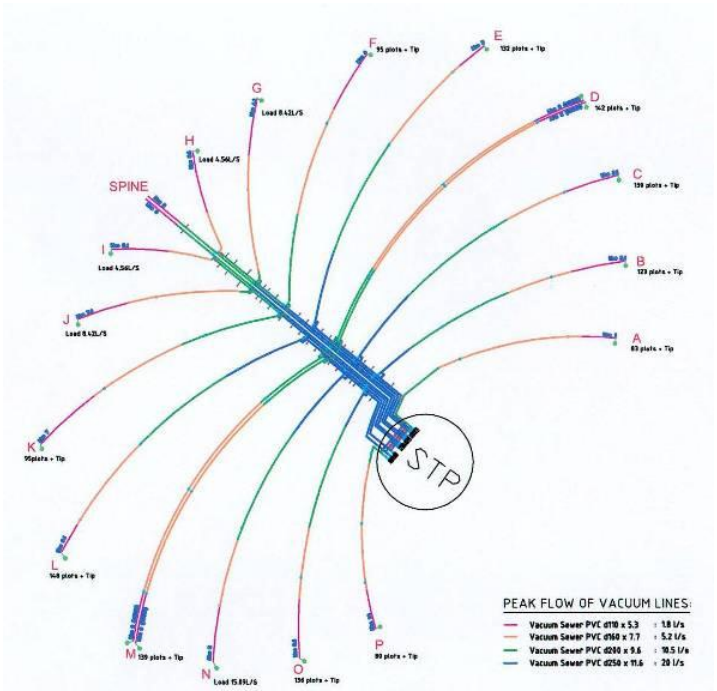
The Palm Jumeirah, United Arab Emirates

The Palm Jumeirah - United Arab Emirates

- 2,300 villas;
- 1200 vacuum collection chambers;
- 23,000 PE;
- No network manholes;
- Shallow trenches;
- One central vacuum station instead of several pump stations;
- Considerable savings of construction cost and time;

Sustainable waste water solutions

The Palm Jumeirah, United Arab Emirates



Vacuum chamber

Service line connection d 90

Main line (d 110 – d 250)

… approx. 40 km vacuum sewer lines…

Sustainable waste water solutions

Pilot scale engineering Brunei

Brunei National Housing - Brunei

- New residential area;
- Approximately 13,000 PE;
- 402 Vacuum chambers;
- Approximately 13 km vacuum network;
- One central vacuum station:
  - Vacuum pumps: 12 x 15 kW
  - Discharge pumps: 2 x 22 kW
  - Tanks: 3 x 25 m³
- Short construction period (24 months);

Thank you for your attention!

Published by
Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Registered offices, Bonn and Eschborn, Germany

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Photo credits
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In cooperation with

UNITED NATIONS ESCAP
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