

SEMIZENTRAL

Opening of the first semizentralized Resource Recovery Center (RRC) in Qingdao



TECHNISCHE
UNIVERSITÄT
DARMSTADT

26 March 2015

Dresden Nexus Conference 2015

Urbanization - The Nexus Approach to Integrated Urban Water
Management



SPONSORED BY THE



Federal Ministry
of Education
and Research

Peter Cornel, Susanne Bieker, Johanna Tolksdorf

TU Darmstadt, Institute IWAR, Wastewater Technology and Water Reuse



Member of

German Water
Partnership

„**Cities of the Future**“ will differ
from those of yesterday and today.

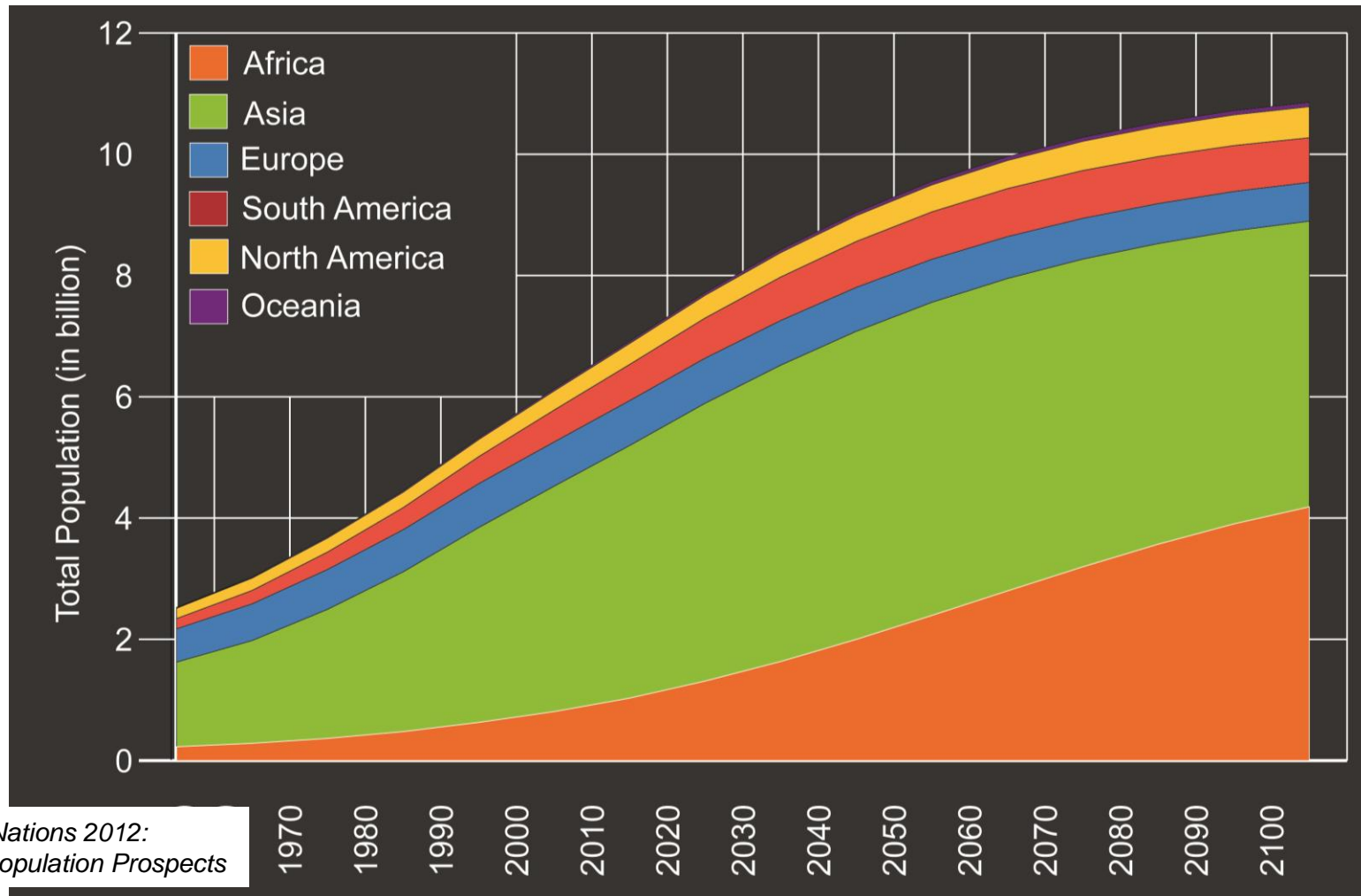
Water and Sanitation Infrastructures will be **much more**
diverse and **varying** and **adapted**
and **flexible** to changing conditions.

Wastewater is not a waste, but a resource

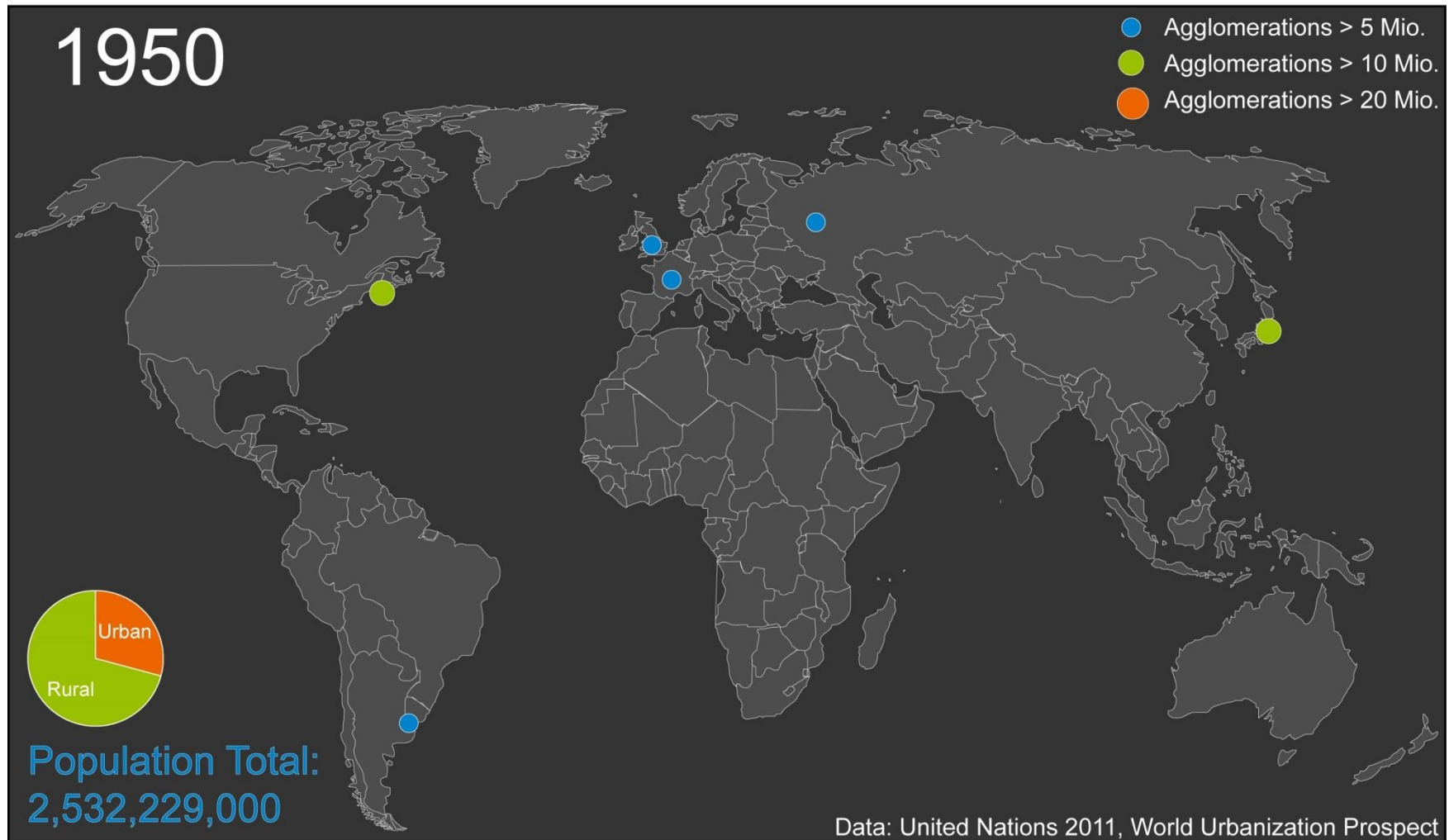
Why not „business as usual“?

- Are we no longer satisfied with „our wastewater treatment“?
- Why can't we keep our system, which has been proven successful for more than 100 years?
- **Counter questions**
 - Did the requirements change during the last 100 years??
 - Can we talk of a success model, if only 10% of the world population are connected to a wastewater treatment plant?
- **Which challenges need to be overcome?**

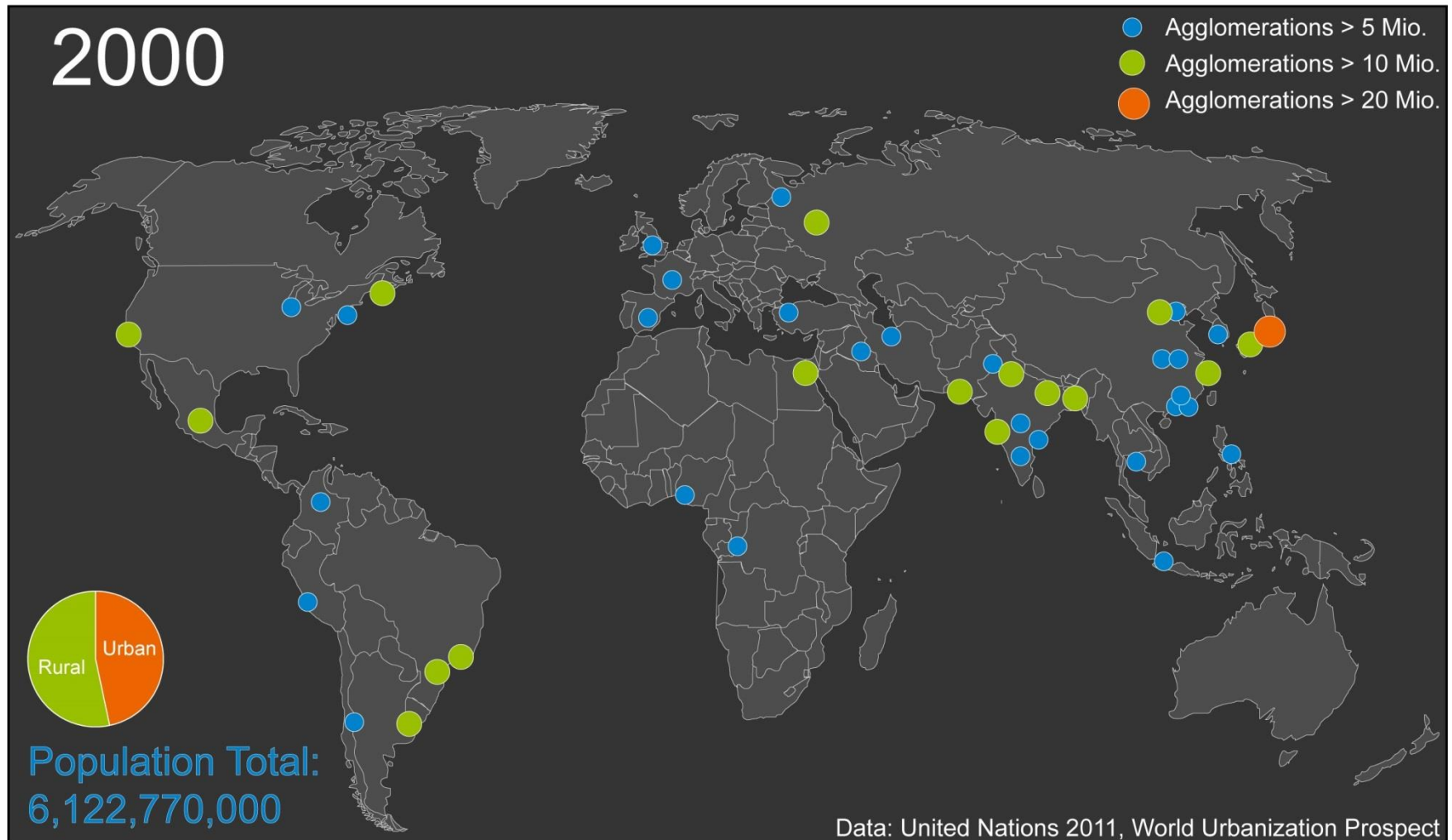
Challenge 1: World Population Growth



Challenge 2: Urbanization



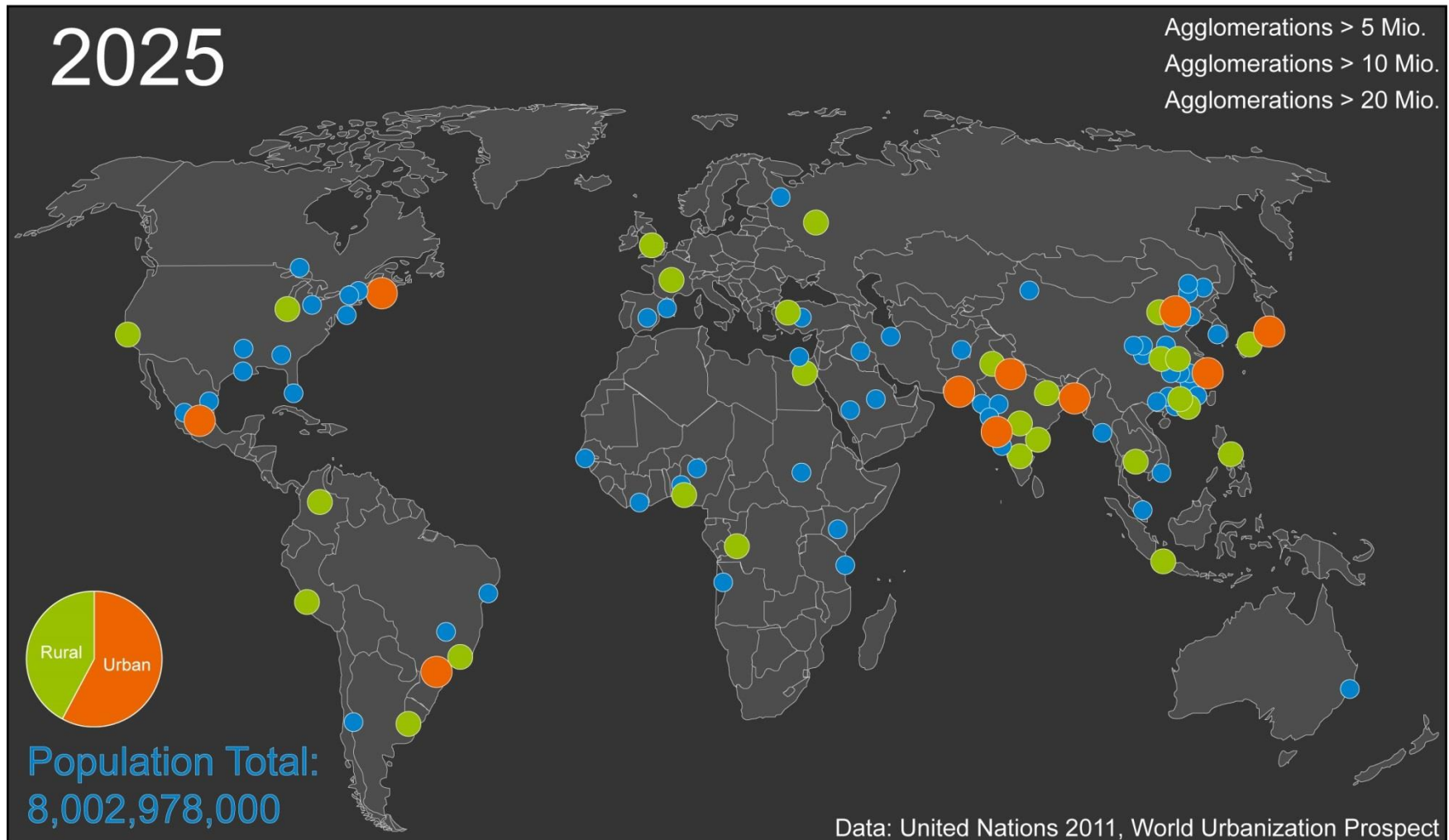
Challenge 2: Urbanization



Challenge 2: Urbanization

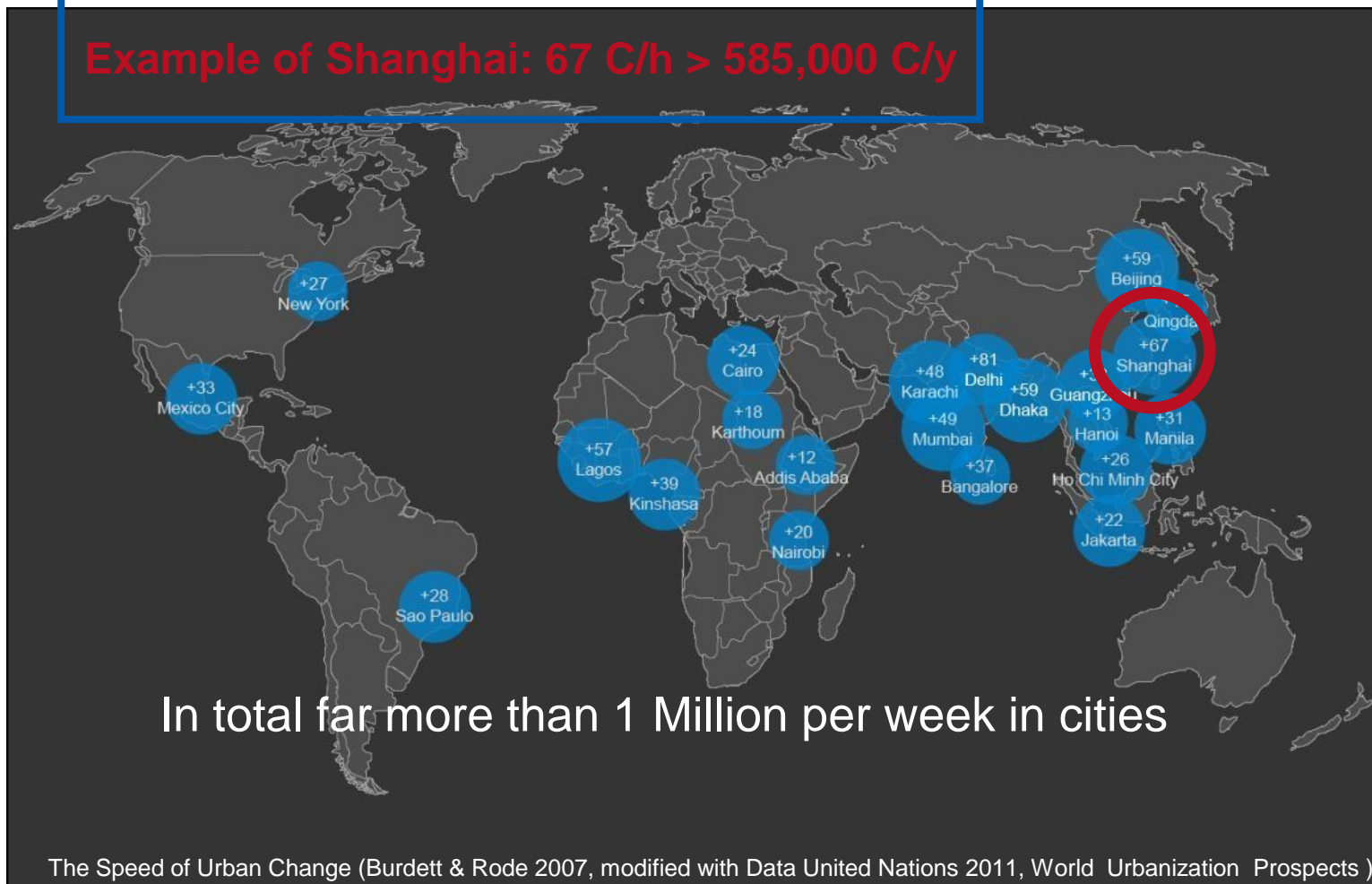


TECHNISCHE
UNIVERSITÄT
DARMSTADT



Challenge 3: Dynamic of urban growth

Example of Shanghai: 67 C/h > 585,000 C/y



In total far more than 1 Million per week in cities

The Speed of Urban Change (Burdett & Rode 2007, modified with Data United Nations 2011, World Urbanization Prospects)

Growth rates e.g. Shanghai



Population growth

67 C/h → **585,000 C/y**

Additional water (daily!)

132 L/(C·d) → **77,200 m³/d**

Additional solid waste (daily!)

1 kg/(C·d) → **585 Mg/d**

Challenge 4: Limited Resources

1. Water



Jialing/Chongqing 2006;
www.zeitschrift.com/magazin/54-wasser.jpg 26.5.2013

2. Energy



<http://www.hvv-mobility.com> 26.5.2013

3. Nutrients (P, N, ..)



www.baektrade.de 26.5.2013

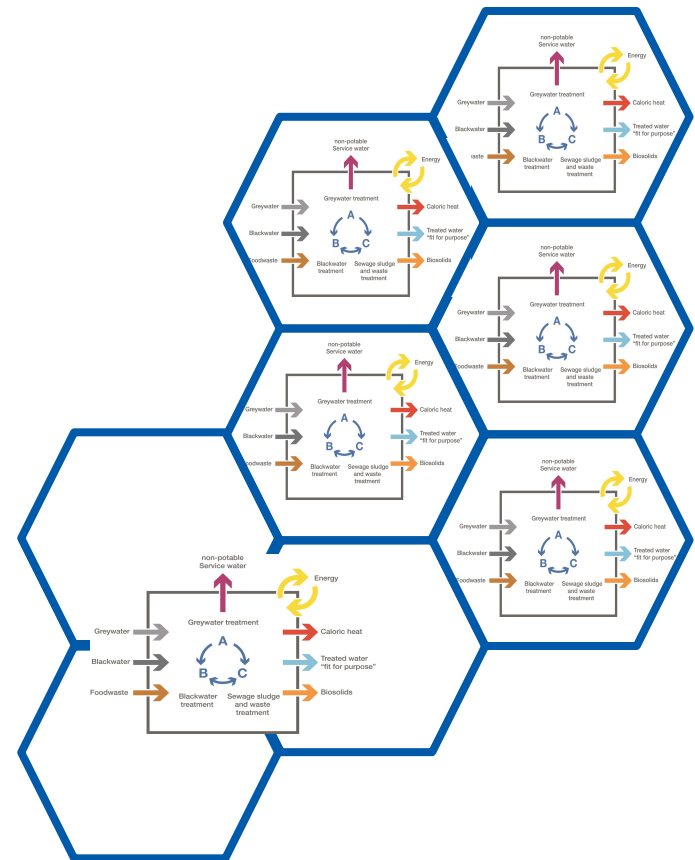
Resource efficiency requires new infrastructure solutions

1. Water reuse fosters **decentralization**
2. Energy (heat) recovery fosters **decentralization**
3. Fulfilling high quality standards foster **professional operation**
→ rather *partly- (semi)- centralized* than *de-centralized* at household level
4. “smaller “ infrastructure is more flexible and reduces vulnerability
(natural hazards, terrorism, ...)
5. **Energy self-sufficiency** fosters combination of different sectors
(water supply, wastewater treatment and waste treatment)

→ We know what is needed ! Why don't we start?

SEMIZENTRAL: Integrated treatment on district level

- adaptable to growth rate
- flexible
- adjusted
- integrated
(water, wastewater, waste, energy)
- enclosed construction → low-emission
- „As small as possible, as large as necessary“
- **Infrastructure on demand**

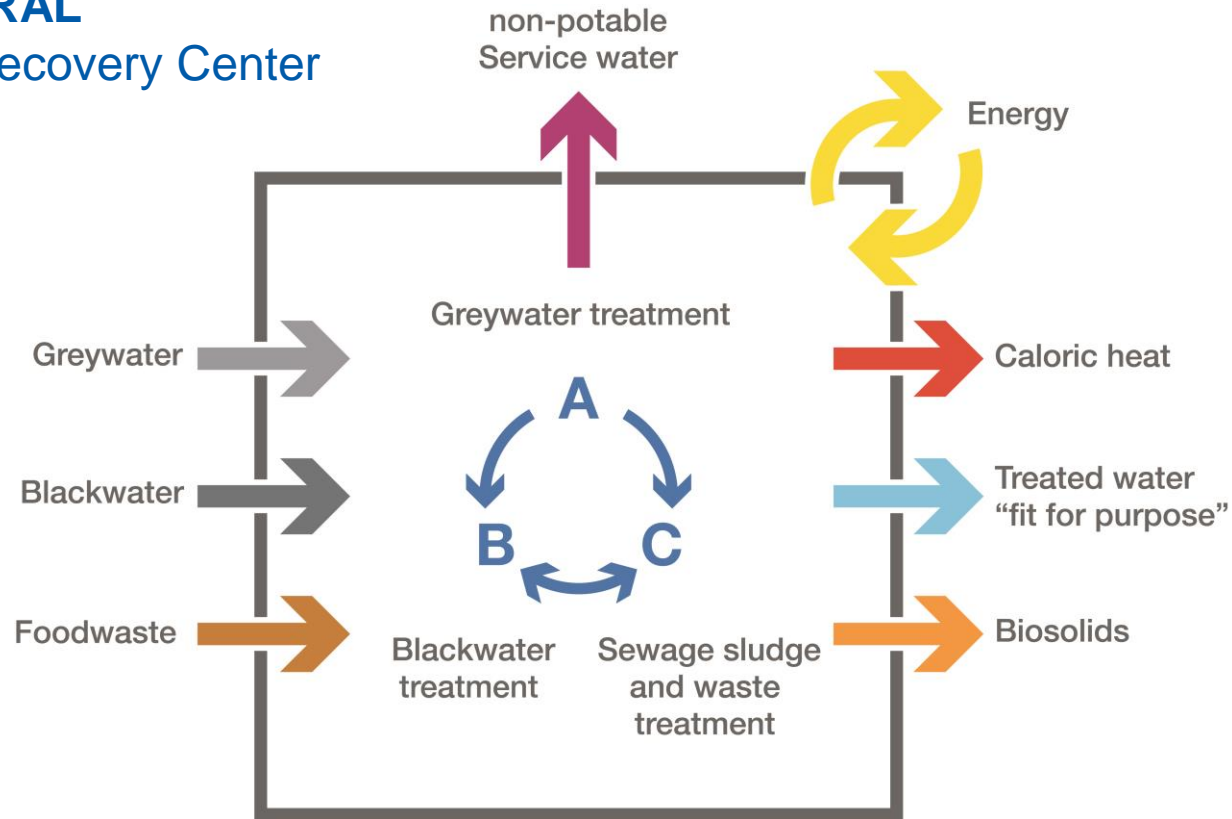


SEMIZENTRAL

Mass flow in the RRC

SEMIZENTRAL

Resource Recovery Center



„SEMIZENTRAL“ Resource Recovery Center (RRC)



- Waste water as a resource for
 - Water
 - Energy
 - Nutrients
- Products instead of wastes
 - Non-potable service water
 - Irrigation water
 - Biogas/electricity
 - Biosolids (stabilized/rich in nutrients)
- Flexible and adaptable

Realization of the first RRC in Qingdao, P.R. China

Emerging metropolis at China's east coast in ShanDong Province

Natural Water resources are deeply limited

(groundwater salination because of seawater intrusion, heavily pollution and/or grounding of surface waters)

- Available water resources not sufficient for higher demands
- Urban growth needs further water

→ The Qingdao solution:
seawater desalination

→ **Energy demand: 3 - 4 kWh/m³**



→ **The SEMIZENTRAL solution:
Reuse for <1 kWh/m³**



CorbisImages

Semicentralized Resource Recovery Center (RRC) – a modular approach

Technical basics

Greywater treatment

- Non-potable service water production with MBR

Blackwater treatment

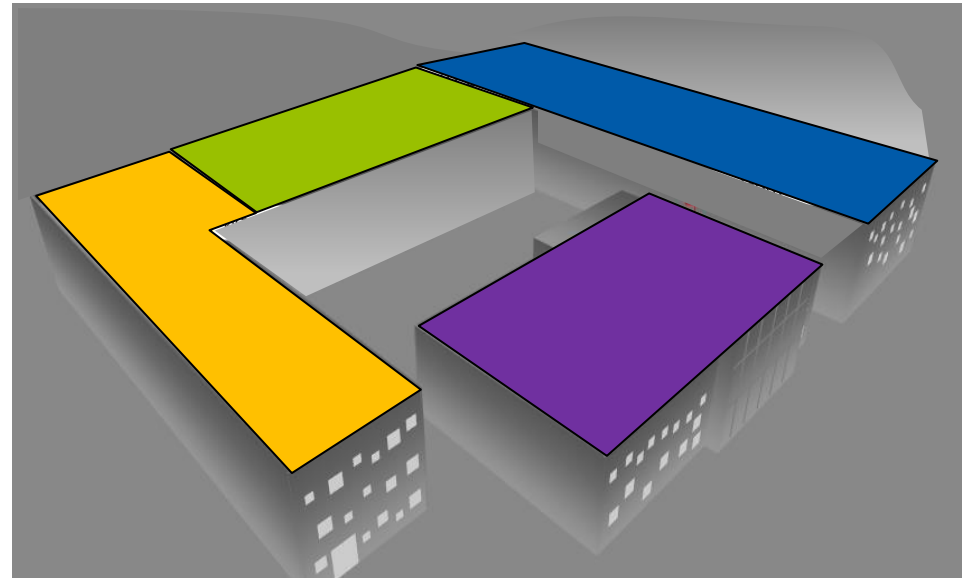
- Irrigation water with MBR

Foodwaste pre-treatment

- Mechanical pre-treatment

Energy-Center

- Anaerobic thermophilic treatment
- Electric energy by CHP station



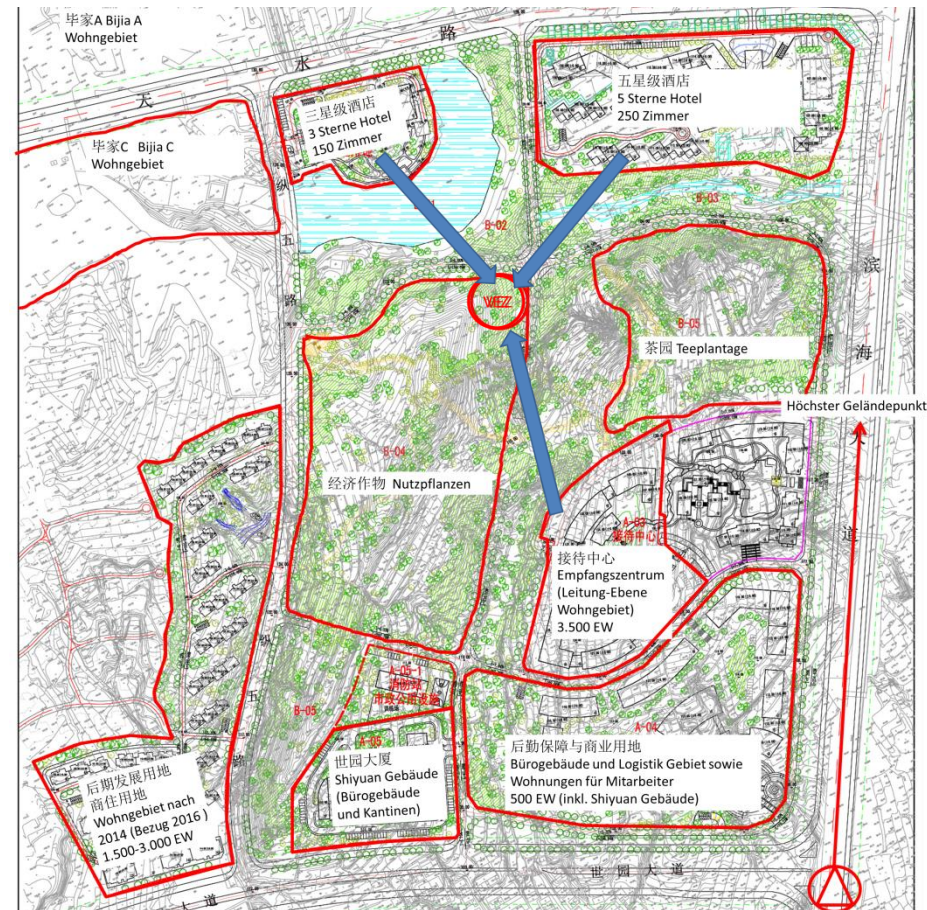
Realization of the first RRC in Qingdao, P.R. China

implementation in context of the 2014 World Horticulture Exposition

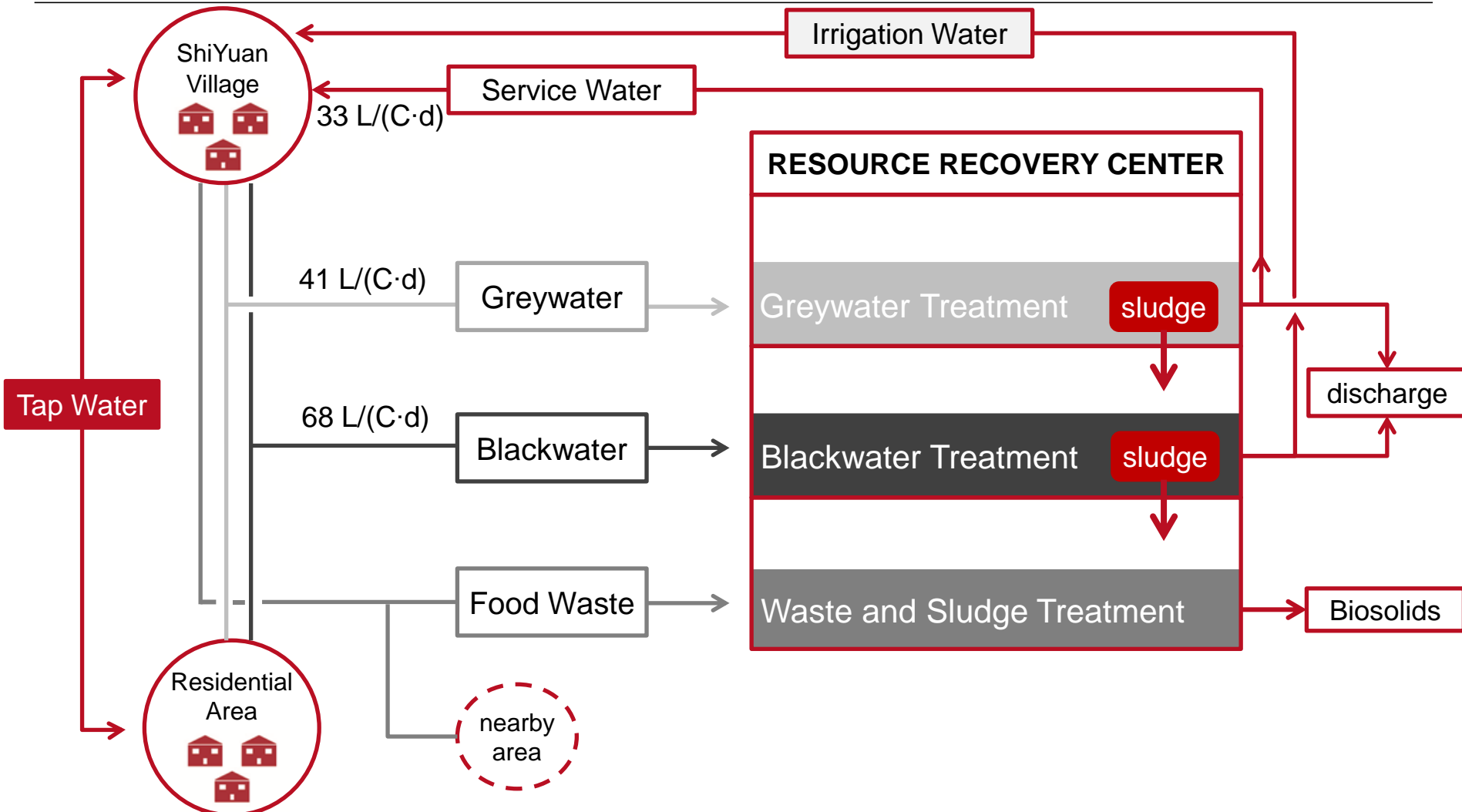
in Qingdao

catchment area: “ShiYuan-village *plus*”

- 3 Hotels
- Housing areas for staff and guests
- New developed housing areas
- Office buildings
- rd. 12,000 people to serve



Material flows within the semicentralized System Qingdao ShiYuan



Advantages of the system

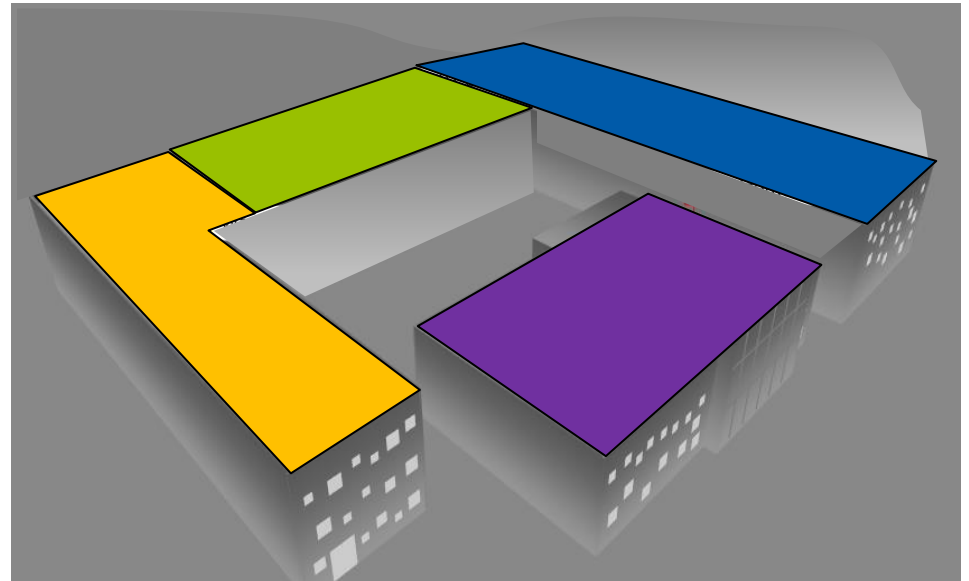
On the water side

recycling rates between

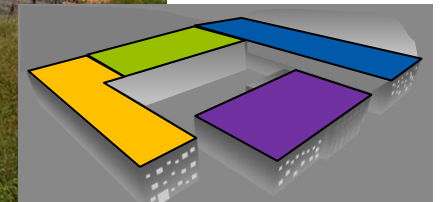
40% (greywater only) and 100% (grey- and blackwater)

On the energy side

Energy self-sufficient operation possible



RRC in Qingdao ShiYuan



Opening ceremony

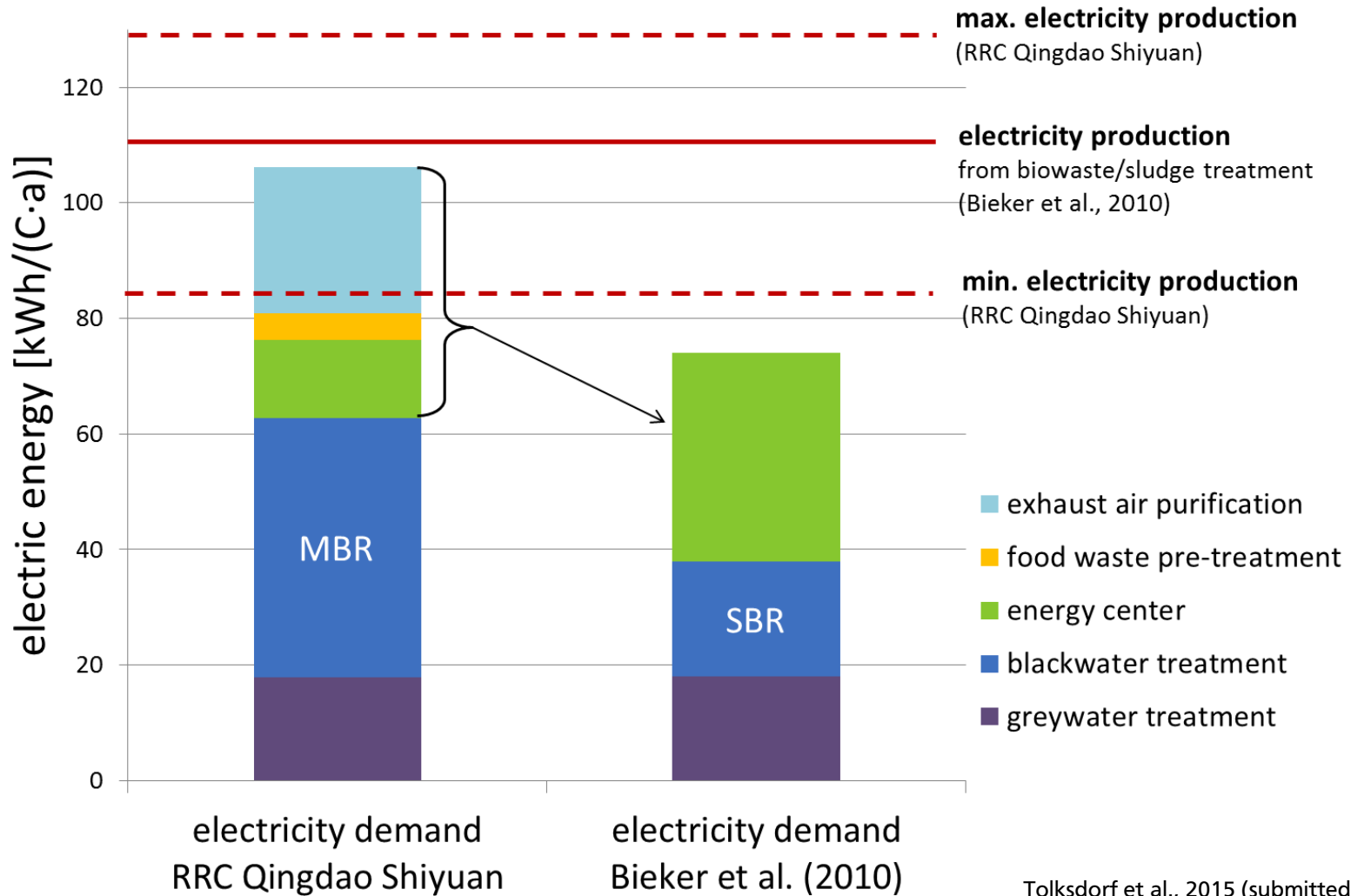
27 April 2014

- **Opening** of the worldwide first SEMIZENTRAL supply and treatment center by
 - **State secretary Dr. Georg Schütte (BMBF) and deputy mayor of the city Qingdao WANG Jianxiang**
 - with participation of the German and Chinese research partners and sponsors



Energy self-sufficient operation

comparison of current calculation with earlier estimations



„**Cities of the Future**“ will differ
from those of yesterday and today.

Water and Sanitation Infrastructures will be **much more diverse** and **varying** and **adapted** and **flexible** to changing conditions.

Wastewater is not a waste, but a resource

The re-use of resources needs equivalent infrastructures

- District-related, co-growing (on demand), „semizentral“
- Water qualities „fit for purpose“
→ toilet flushing water doesn't need drinking water quality
- Integrated infrastructures
(water, wastewater, biowaste, energy production)
- **Health protection** accounts for **professional operation**
(„as small as possible, as big as necessary“)

SEMIZENTRAL

Opening of the first semizentralized Resource Recovery Center (RRC) in Qingdao



TECHNISCHE
UNIVERSITÄT
DARMSTADT

Dresden Nexus Conference 2015

Urbanization - The Nexus Approach to Integrated Urban
Water Management

25 – 27 March 2015

www.semizentral.de



SPONSORED BY THE



Federal Ministry
of Education
and Research



Member of

German Water
Partnership