ATWARM International Conference 2013

"Water - The Greatest Global Challenge"

Water challenges & opportunities in Brazil for new technologies

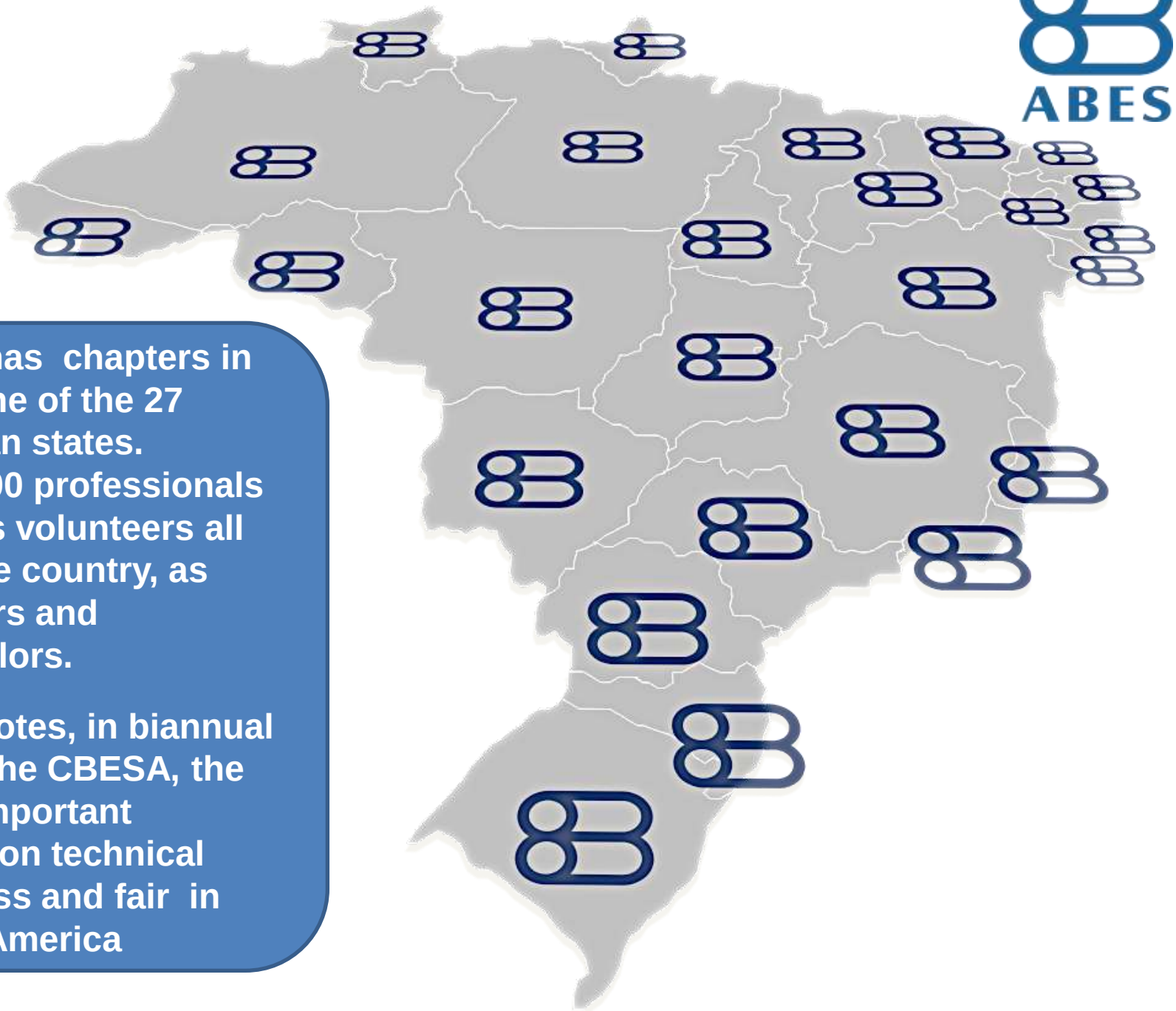
Marcelo Morgado
ABES – Braz. Association of Sanitation and Environmental Engineering

Dublin, 16th May, 2013

Topics

- Abes in a short glance;
- Brazilian sanitation scenario;
- The main companies in the sanitation business;
- Main forms of waste water treatment in place;
- Main type of monitoring technologies currently in use and usual parameters;
- Tecnology opportunities and possibilities for funding of joint research initiatives.

ABES overview



ABES has chapters in each one of the 27 Brazilian states.
Over 400 professionals work as volunteers all over the country, as directors and counselors.

It promotes, in biannual basis, the CBESA, the most important sanitation technical congress and fair in South America

ABES has 10,000 individual and corporate members.

It is represented at the most significant councils and forums of the Brazilian Environmental and Sanitation Sector, such as :

- CONAMA – National Council for the Environment
- CNRH - National Council for Water Resources
- CEMA – State Environmental Councils

Publications

Books and two magazines (one of them is B1 ranked)

ABES

NATIONAL PROGRAM FOR PROFESSIONAL TRAINING - PAAP

ABES

PAAP

ABES National Program for Professional Training

- ✓ **ABES has its own Capacitation Program. In 2011, 6.000 professionals were capacitated thru the 250 courses offered nationwide.**
- ✓ **EAD – Starting on May 2012, the first modules for distance learning will be available at the Abes's website (www.abes-dn.org.br)**

Basic information about Brazil sanitation sector

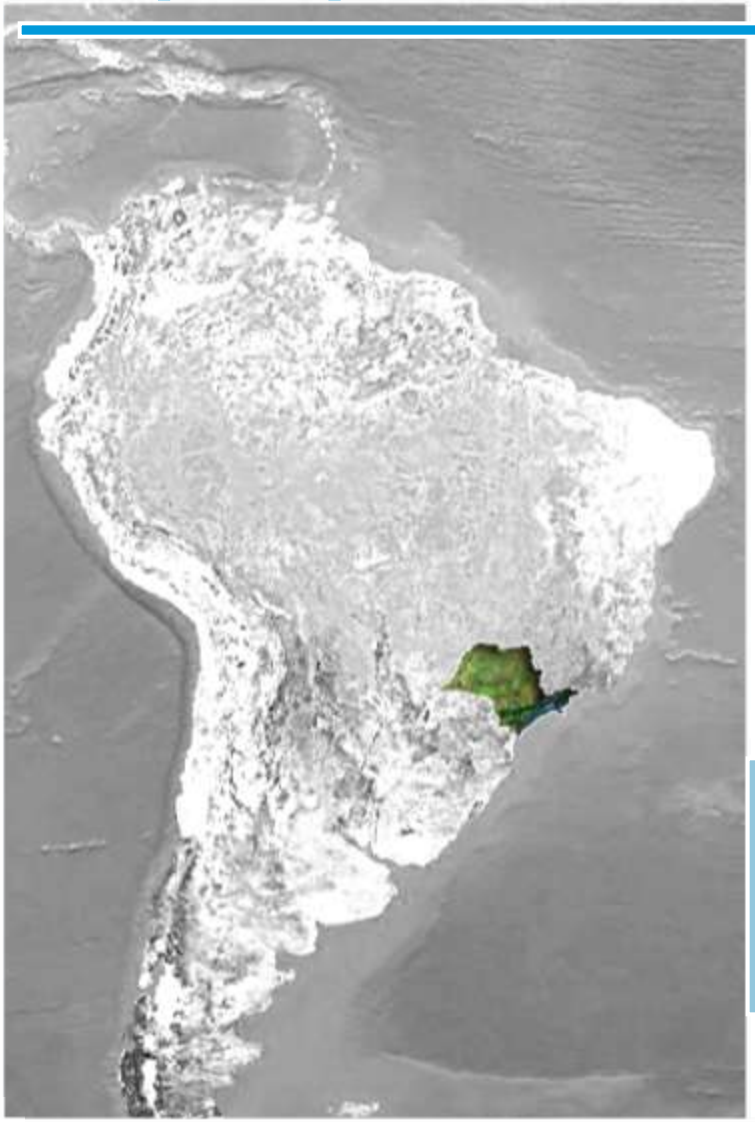
Brazil and São Paulo in a comparative perspective...

Indicators 2007/08	Brazil	São Paulo	Argentina	Chile	China	Índia	Russia	USA	Israel
Population *(million)*	186	**41**	40	16	1,32	1,123	142	298	7
Area *(1000 km²)*	8,514	**248**	2,780	757	9,59	3,287	17,07	9,63	21
GDP *(billion US$)*	1,313	**445**	259	163	3,25	1,09	1,29	13,84	186
GDP per capita *(1000 US$)*	7.059	**10.85**	6.475	10.19	2.46	0.98	9.08	46.46	28.47

Ireland Rep.: 4.6 inhab.; 70,273 km²; GDP: US$ 210.416 bi and GDP per capita: US$ 45,888

Source: IMF, Seade Foundation, IBGE

Brazil and São Paulo in comparative perspective...



São Paulo and Brazil

3%	of the area
22%	of the population
33%	of GDP
33%	of exports
40%	of imports

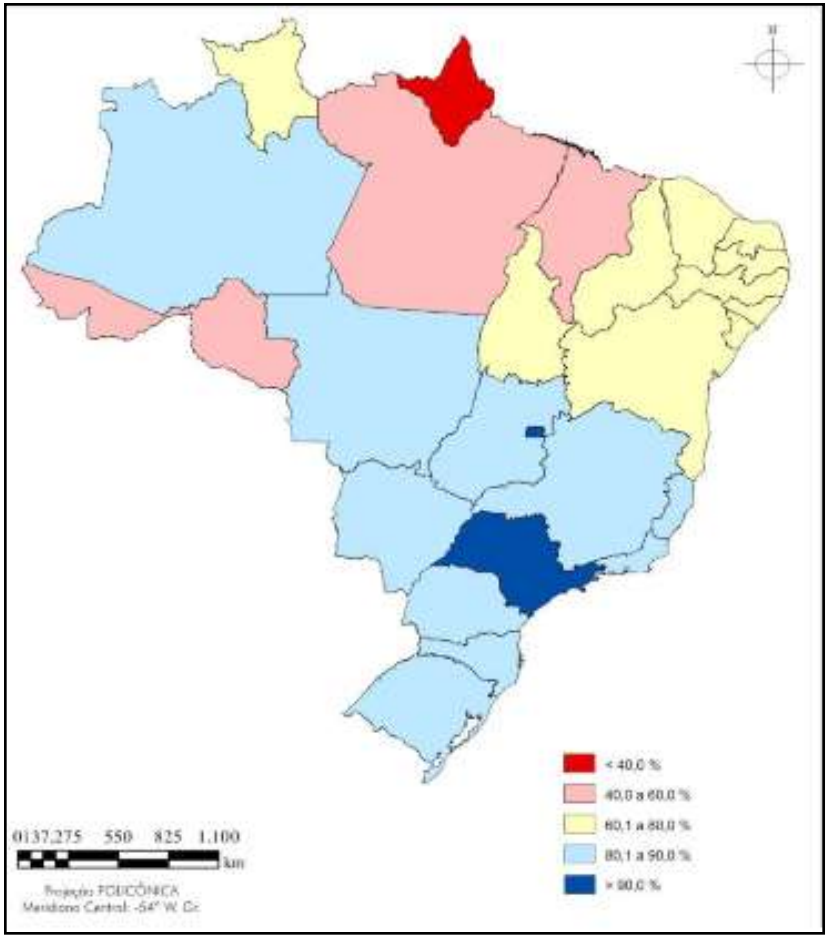
41	million inhabitants
645	municipalities

Source: IBGE, Seade and Banco Central de Brasil

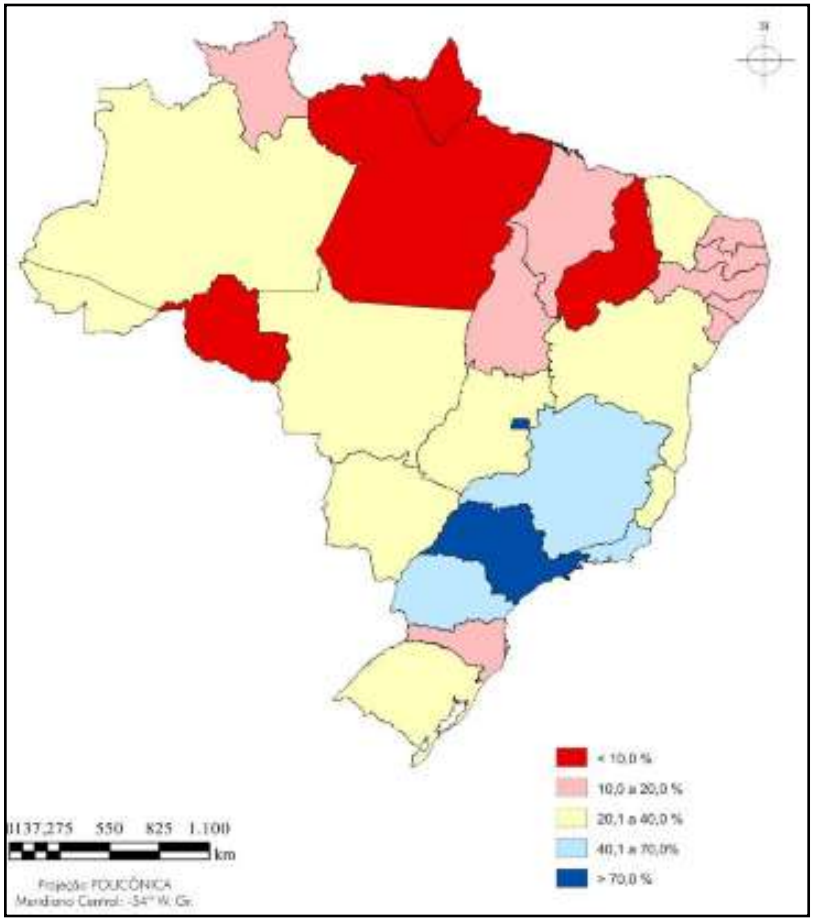
GOVERNO DE SÃO PAULO

Expansion of wastewater services is a major challenge in Brazil…

Water service



Wastewater service



Source: SNIS 2011

Sanitation index in the Brazilian regions (%)...

Region	Water	Sewage collection	Sewage treatment
North	62,7	6,1	8,4
Northeast	92,5	26,4	31,9
South-east	95,7	69,6	33,7
South	99,2	35,2	28,2
Mid-west	98, 0	45,9	42,8
Brazil	93,1	48,3	32,2

% of treatment on collected volumes

Source: SNIS, 207

Brazilian sanitation deficiencies...

- **105 million** don't have acess to wastewater collection (source: IBGE – Braz. Inst. of Geog. and Statistics);
- **Wastewater coverage fell** from 59,3% in 2008 to 59,1% in 2009 (source: PNAD – Homes Sampling Nat. Survey);
- **8 millions** don't have acess to bathrooms (source: Inst. TrataBrasil)
- **With the current investments level it will take 50 years for universalize the services** (source GO Associates)
- **A theorical two networks system (sewers separated from storm water piping). Although an increase of till 15% of wastewater during the rainy season.**

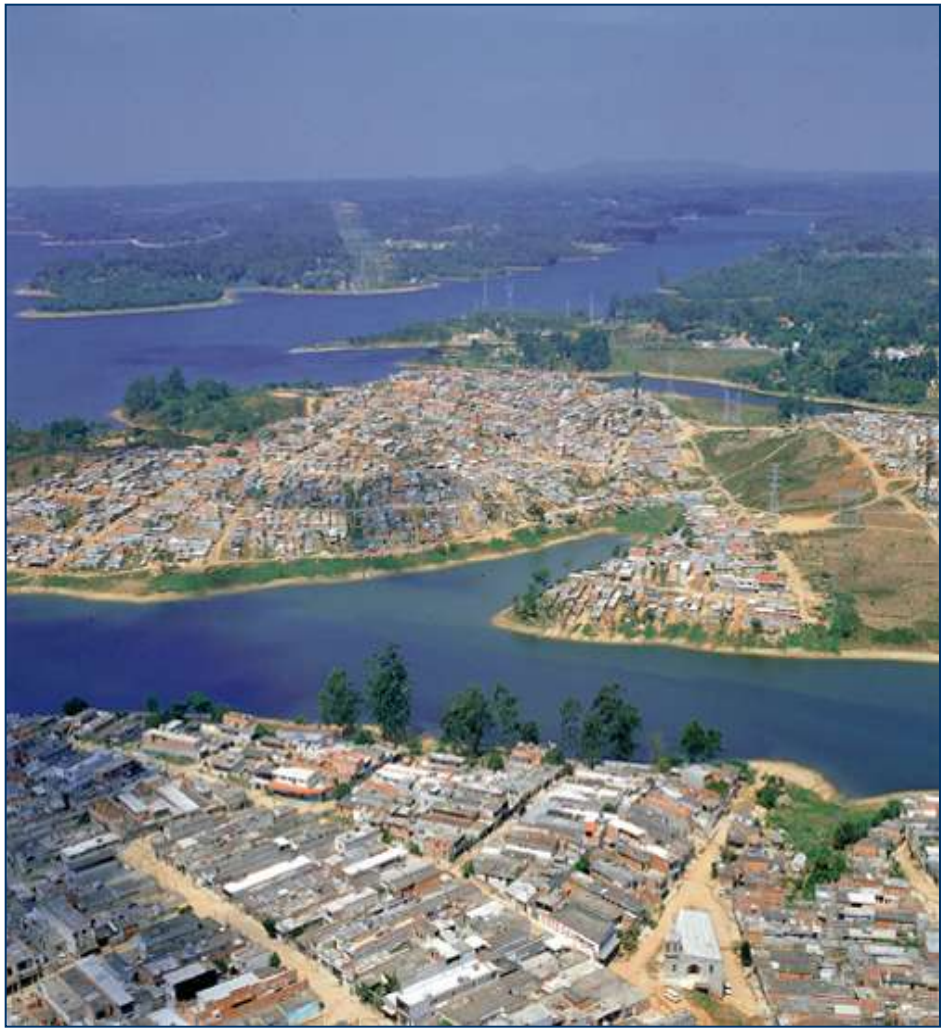
Even São Paulo, the most developed state, faces tremendous challenges…

The challenges of the metropolitan area of São Paulo are enormous...

São Paulo s slums. In general in invaded areas and utilities are prevented by Public Attorney to offer services. 2 million people among 20 million total population.
It is difficult to lay down piping since margins of rivers and streams are frequently occupied by irregular houses in the poor neighborhoods.

Paraisópolis: a symbol of inequality...

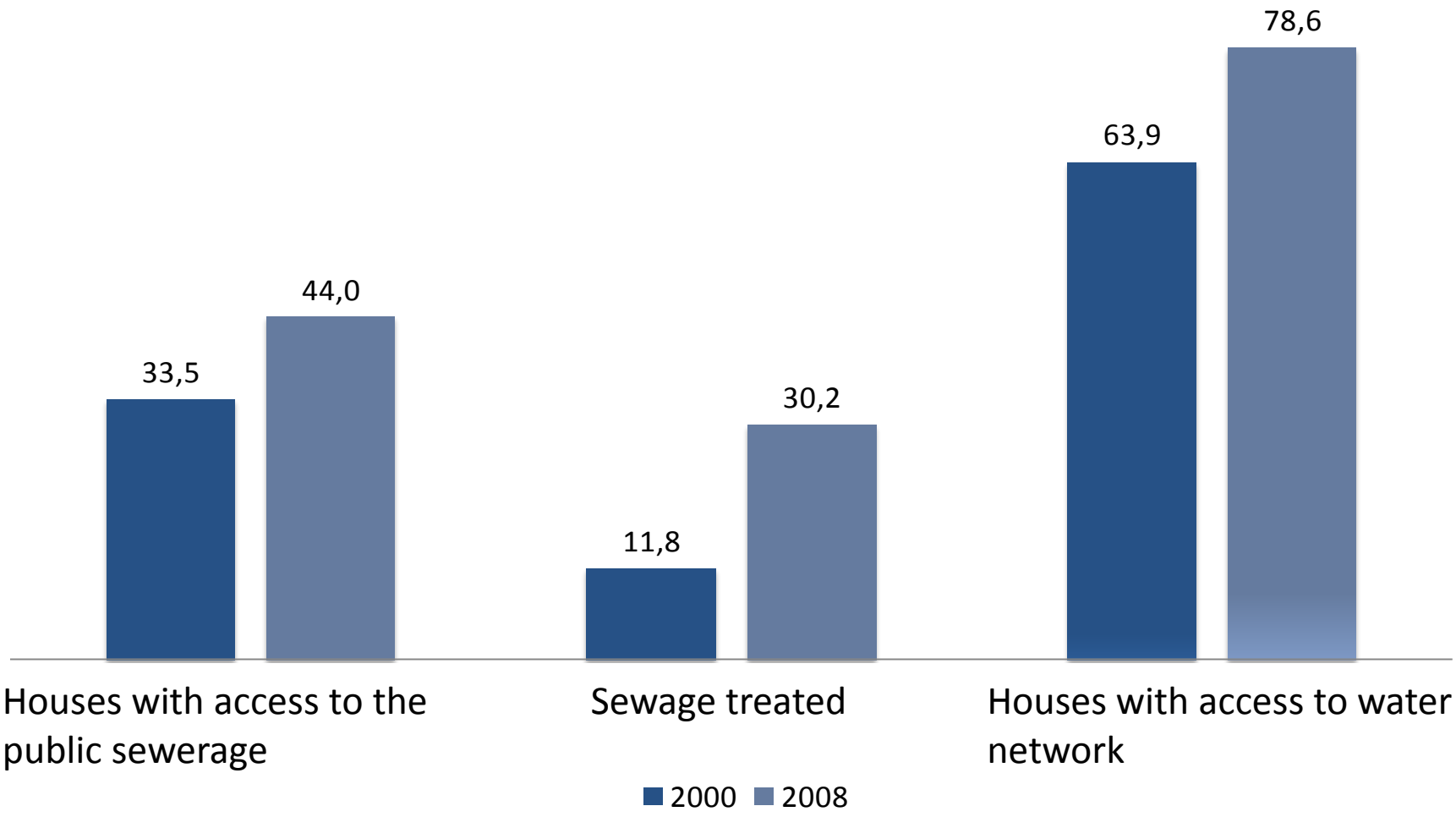
Two dams with slums along the margins: Billings and Guarapiranga built in the 30s for providing water for São Paulo



Guarapiranga

Billings

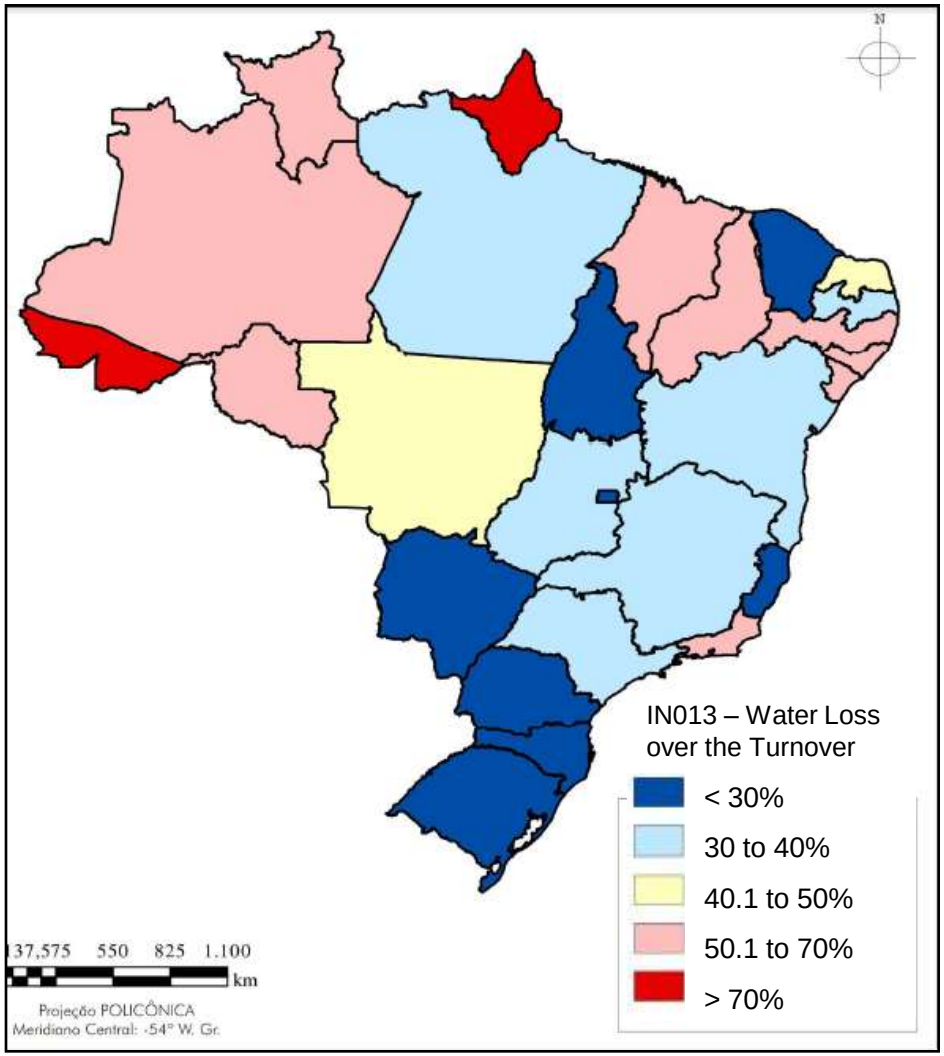
Brazilian population with access to water and sewerage collection (%)



Source: IBGE, Pesquisa Nacional de Saneamento Básico 2000/2008

Water losses (non revenue water)

There are huge water losses in Brazil...



- Losses of companies operating statewide: 43.7%
- Losses of companies operating municipalities individually: 39.0%

Source: SNIS – Nat. Syst. of Sanit. Inform. 2009

High levels of NRW...

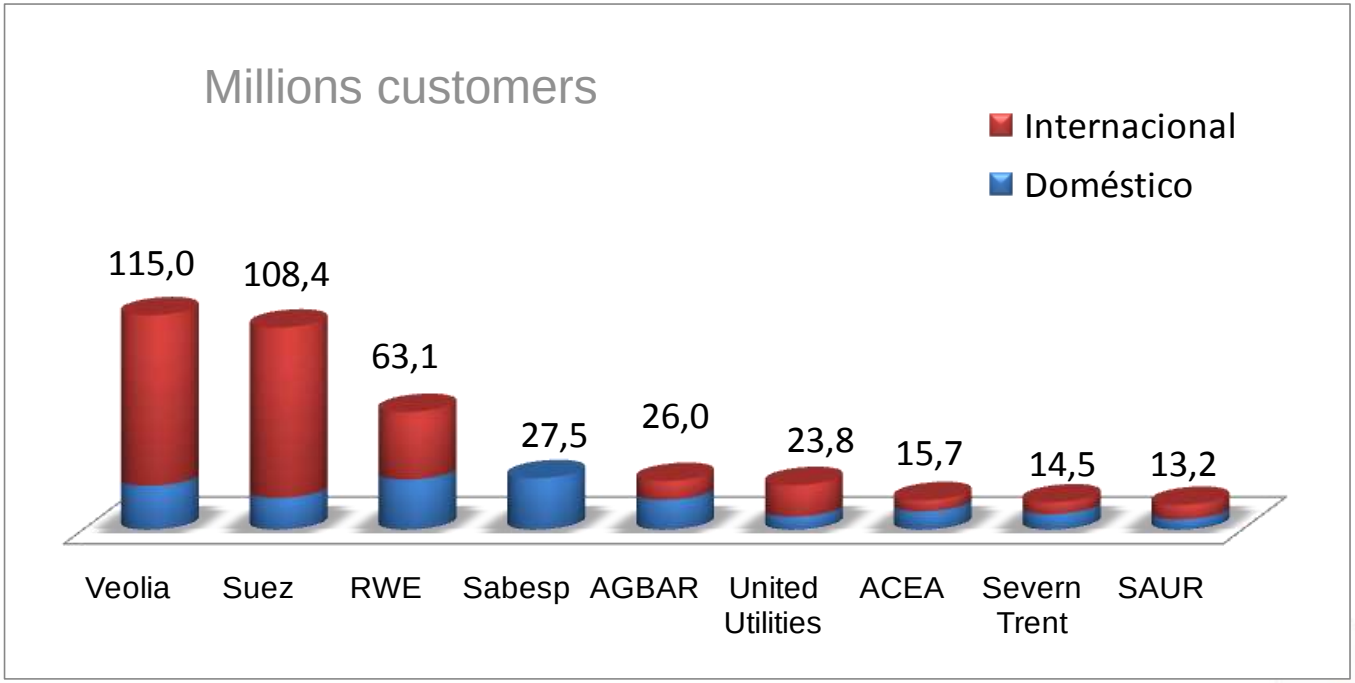
- Northern region NRW exceeds 60%;
- Average NRW in Brazil is 37.4%, despite hundreds of cities with less than 15%;
- Average NRW in Latin America is of approx. 50%.

Main sanitation companies

Brazil has set up state water utilities...

- State controlled companies were formed in the 1970s in order to provide water and sewerage services;
- In the States of São Paulo, Minas Gerais and Paraná, SABESP, COPASA and SANEPAR present reasonably good performance and introduced innovations in terms of internal incentives, corporate governance and competition. Sabesp listed at NYSE since 2002 and is the current 4th ww largest sanitation company, investing US$ 1 billion per year.

Sabesp among the top five world utilities



Source: Pinsent Masons – water Yearbook – 2011-12
includes 3,1 million clients in municipalities currently served on a wholesale basis

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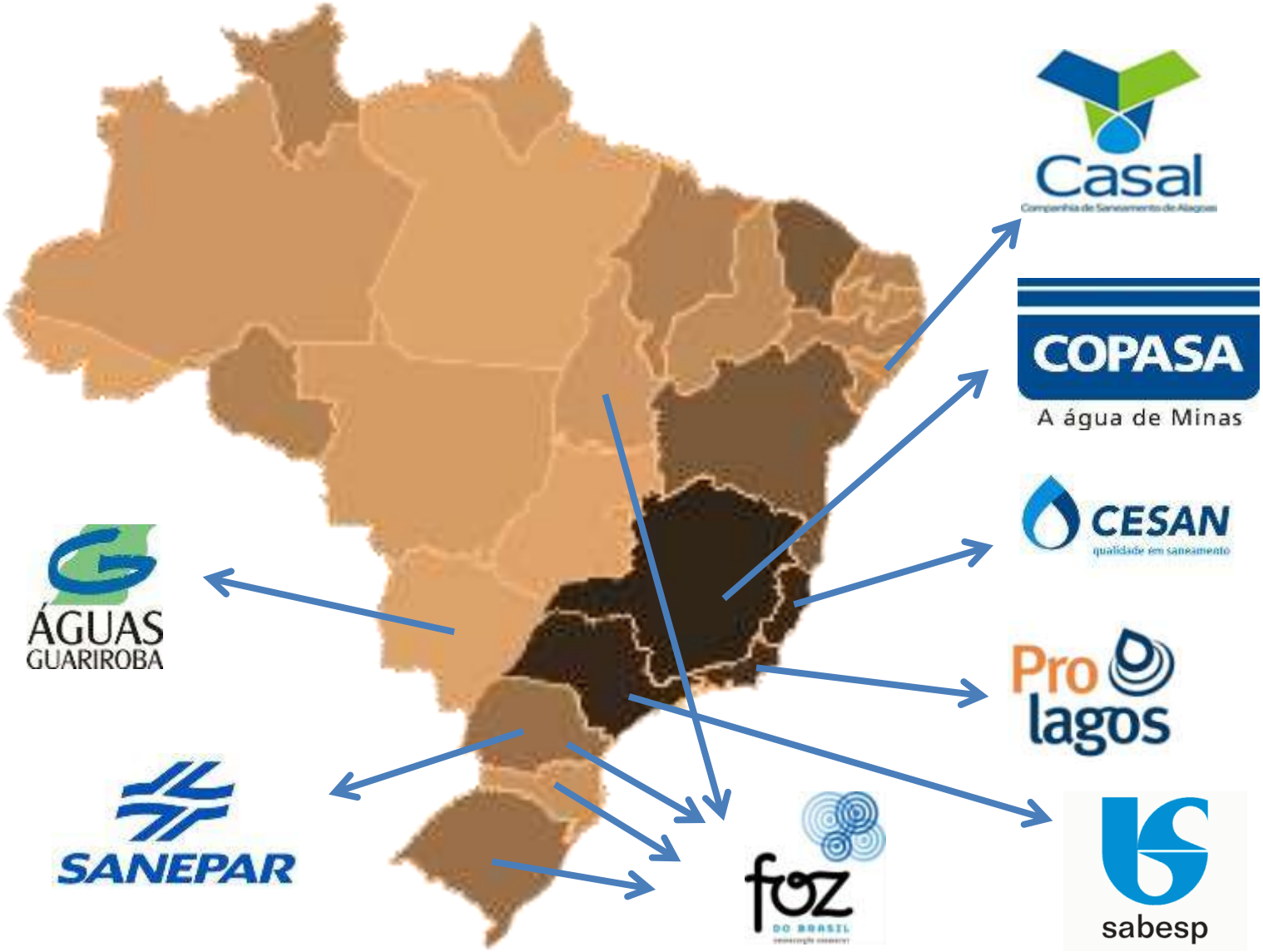
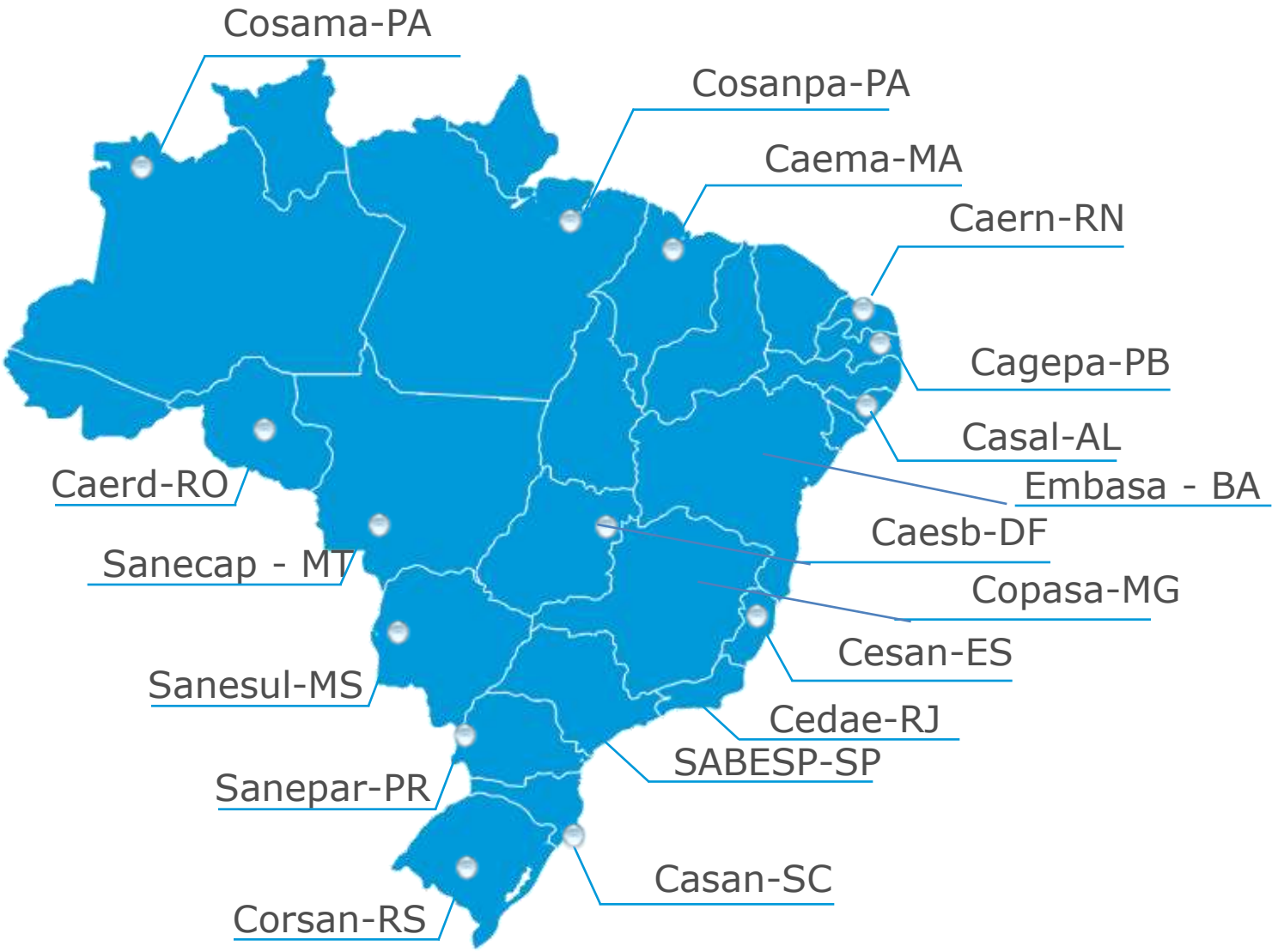
A few examples of public and private water companies in Brazil...



State companies provide water services for 70% of the Brazilian population...



New incomers: Private companies controled by building contractors like Foz do Brasil of the Odebrecht Group

- Created in 2008, present in 150 cities and several states;
- Provide services for 8.3 million people and has invested US$ 5.2 billion in five years.

At the current rate of investment, it will take 50 years to achieve universal services…

Universalization of Brazil's Sanitation Sector

Scenarios	Year of universalization		Investments	
	Water	Wastewater	Universal.	Until 2060
1 – Maintenance of current investment levels	2039	2060	R$ 255 bi	R$ 255 bi
2 – Double of the current investment levels	2021	2031	R$ 220 bi	R$ 255 bi
3 – Maintenance of current investment levels with a 30% increase in produtivity	2028	2042	R$ 165 bi	R$ 186 bi
4 – Double of the current investment levels with a 30% increase in produtivity	2017	2024	R$ 150 bi	R$ 186 bi

1 US$ = 2 R$

Source: GO Associados

Sanitation is one of the least developed sectors in the Brazilian infrastructure…

Some politicians used to say that sanitation doesn't bring votes, since all the works are buried.

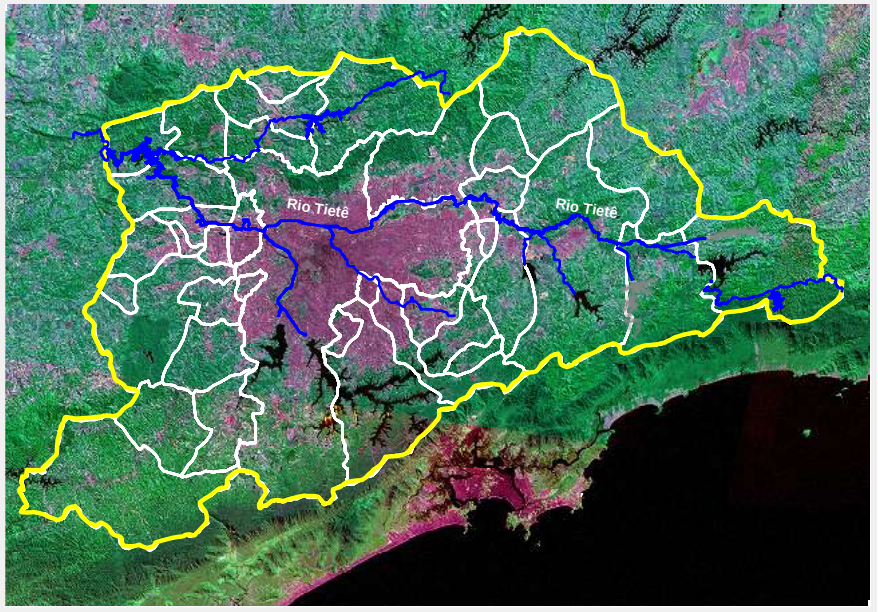
Source: Dr. Mascarenhas – CNI (Fórum Estadão, 13/09/2012)

The major institutional changes of the last decades...

1970 Planasa	2007 – new water & sanitation Law
Concession contract	Program Contract
Self regulation	Regulatory agency
Public financing	Market financing
Focus on the construction works	Focus on the client
Natural monopoly	Competitive environment
Water as a free good	Water as a very scarce resource and with a price itself

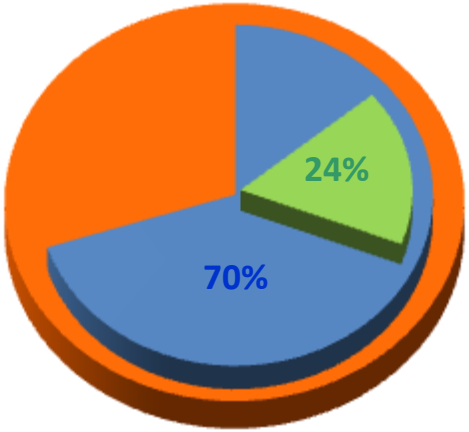
São Paulo Metropolitan Region – SPMR

- Area – 8,051km²;
- 39 cities;
- 20 million people - 10% of Brazilian population;
- Low hydric availability (water supplies comes from water sources till 120 km far from downtown);
- Complex water resources management, facing many disputes with neighboor watersheds.

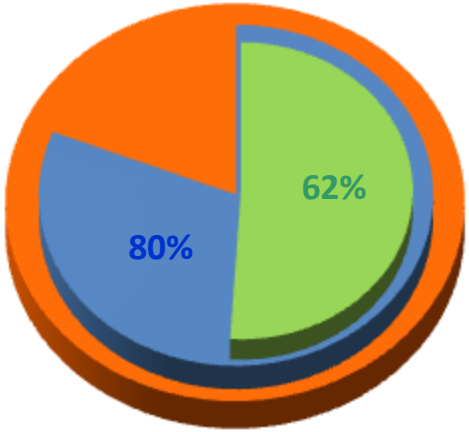


- **Progress of the Collection and Treatment Ratios…**

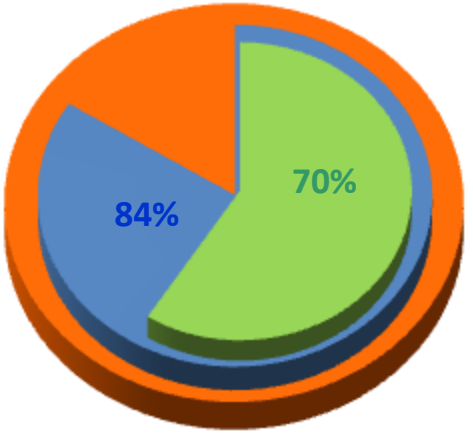
1992
Population: 15.3 million



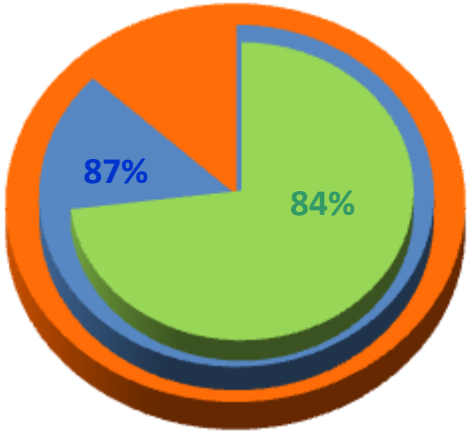
2002
Population: 17.5 million



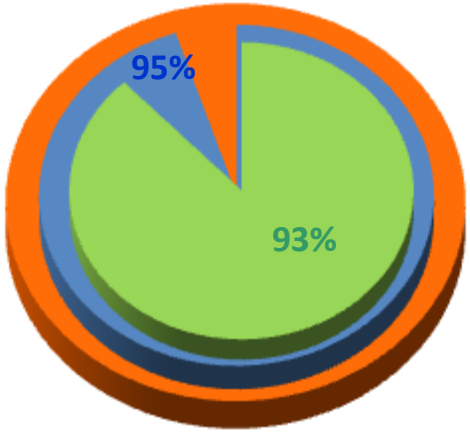
2008
Population: 18.8 million



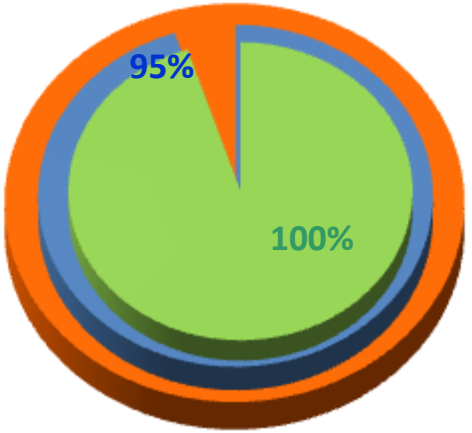
2016
Population: 20.9 million



2018
Population: 21.4 million



2024
Population: 22.4 million



Total Sewage generated in the SPMR **Collected** **Treated**

• Tietê project...

US$ 2.5 bi since 1992 (IDB financing).
Collection: 70 to 84%
Treatment: 24 to 70%

Resulted in sewage services to 8.5 M inhab. (= London). Although at S. Paulo the river is still dead.

Concrete outcome: 120 km retreat of the pollution plume in the Tietê river

- **Tietê project: general overview…**

(IDB – Interam. Devel. Bank financing)

1st Phase

1992-1998

US$ 1.1 billion

2nd Phase

2000-2008

US$ 500 millions

3rd Phase

2009-2015

US$ 1.05 billion

Source: Sustainability Report 2008

Main forms of waste water treatment in place

Waste water treatment technology

- At most of the inland and at small municipalities: stabilization ponds, usual configurations: anaerobic + facultative + maturation. Aerated ponds in growing use for improving performance and abating bad smell. Septic ditches + anearobic filters for rural areas and coast villages. Only a few MBBR and wetland plants;

- At major cities: prolongated activated sludge;

- At Paraná is relatively common UASB (upflow anaerobic blanket reactor) + AS tanks. In general UASB suffer from prejudice due to a lot of cases of clogging, steel and concrete corrosion, poor performance and bad smell);

- MBR with increasing adoption at industries for reuse purposes. Sabesp is building its first WWT plant for 120 L/s. Sanasa has started up in 2012 a plant for 300 L/s;

Main type of monitoring technologies currently in use and usual parameters

Monitoring in sanitation in Brazil

- Automatization efforts for small isolated water treatment plants based on turbidity and pH signs. Studies for control in large sites using Zeta potential and on flocculation sweeping analysis. For small sites automatization based only on turbidity and pH signals;
- Eventual opportunities for water security surveillance systems (offered by British and Israeli firms) considering major international events;
- On line phosphate measurement in dams could be very useful considering eutrophization and algi blooms prediction and modelling;
- Methane and CO_2 release measurement in ponds under tests with DCU & USP, considering GW mitigation and eventual carbon credits;
- Currently poor monitoring of water sources: Sabesp has 7 buoyance systems for transfering data from a dam and at least in one river there is a sensor device for detecting hidrocarbons due to the reasonable risk of accidents with chemicals lorries passing through a road nearby;
- DO on line photchromatic oxymeters interlocked with blowers in major WWT sites.

Monitoring by Gov. agencies

- Cetesb (Sao Paulo State Envir, agency) has a netwotk of 7 telemetric stations along Paraiba do Sul river collecting pH, DO, conductivity, turbidity and water level. They take samples for checking quality by 35 parameters multiplyed together in a weighted geometric average for getting a percentage index – www.cetesb.sp.gov.br;

- ANA (Nat, Water Agency) monitors 2176 of the 12963 Braz. Rivers through 2239 points, 1793 are telemetric but only collecting flow and pluviosity information for dams control (80% of Braz. Electricity is hydropower) – www.ana.gov.br.

Typical parameters at WWT plants

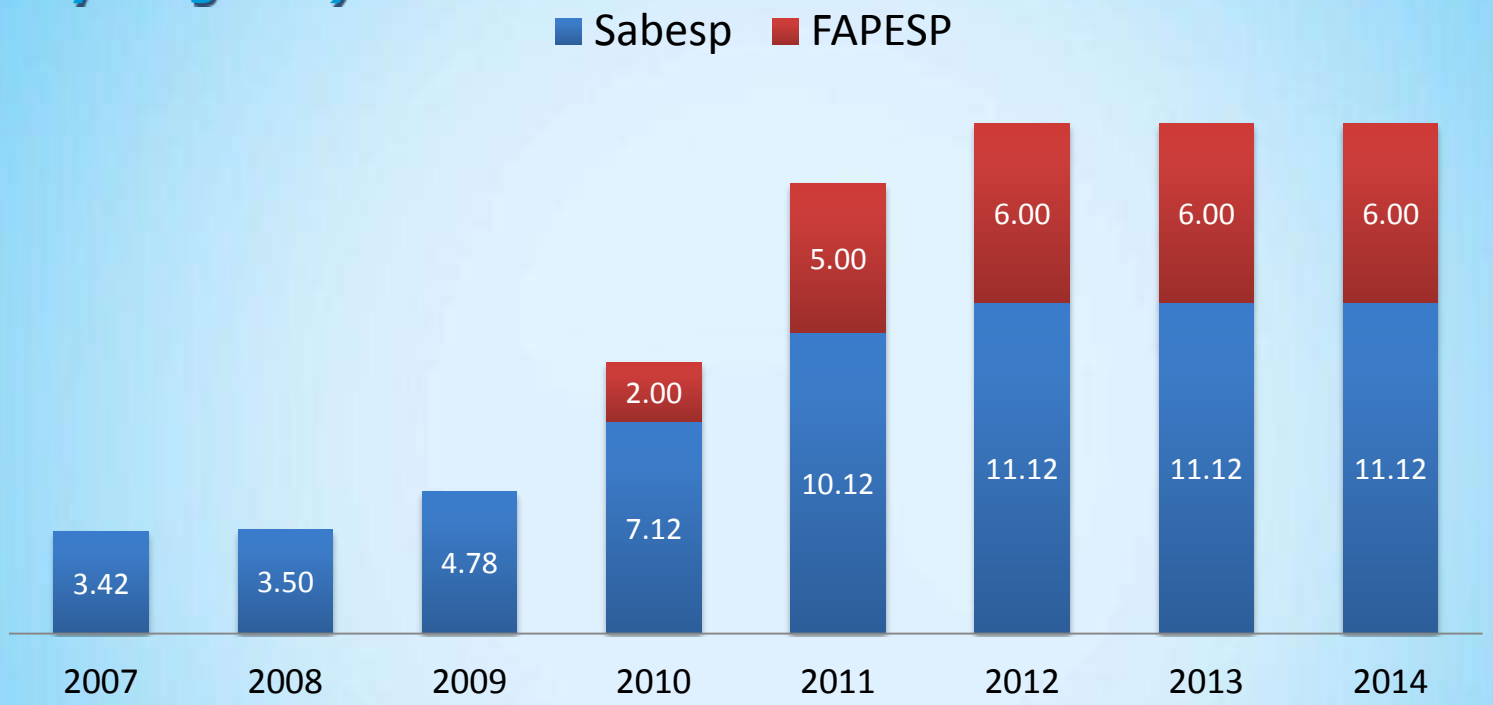
- BOD_5
- COD
- Solids series
- NKT, nitrates
- Surfatants
- DO (on line – photocromical sensors)
- P total SST < 1,0 mg/l
- Turbidity
- Coliformes
- Respirometry for process development

Tecnology opportunities and possibilities for funding of joint research initiatives

General Gov. Funding for R&D

- Most of R&D funding comes from Fed. Gov. and most of the reasearch is perfomed by public universities. The main one is Sao Paulo's University (SP State ruled);
- CNPq (Science Min.) is the main Fed. Agency with an annual budget of US$ 550M;
- CAPES (Educ. Min.)provide scholarships for MsC and PhD iwth annual US$ 1.5 bi
- Science without Frontiers is a US$ 1.6 bi programme offering 101,000 scholarships during 4 years for MsC and PhD at 22 countries including Ireland. It includes 2000 scholarships for foreign researchs (1 month in Brazil – US$ 7,000 + 3 round-trip tickets;
- FINEP supports innovation for industry with a budget of US$ 3 bi;
- There are other funds like Fapesp and Faperj at state levels.

Through a partnership with Fapesp, Sabesp will invest US$ 25 millin in 5 years in R&D (energy efficience, membranes, sludge recycling etc.)



FAPESP is a leading R&D financing agency sponsored by S. Paulo State gov. Annual budget: US$ 200 millions.

FAPESP

SABESP

•Specific technical solutions for smaller and isolated villages...

Small and modular wastewater treatment plants for small villages (300 people)

Individual wastewater solution

Smalland modular water treatment plant

Building of small hydro plants using the falls of existing dams overflow

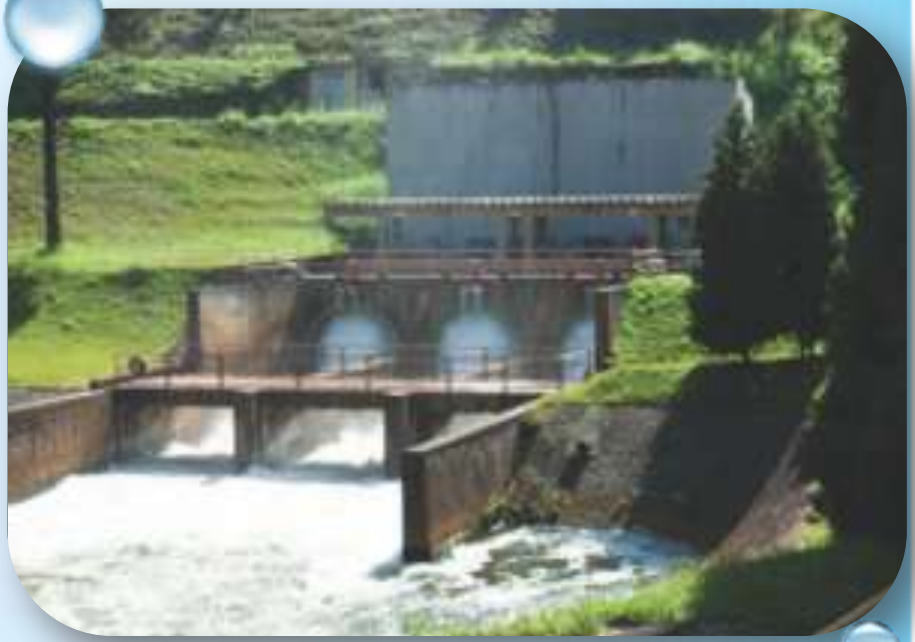
Schedule and deadlines :

Contract subscription :
- December/09;

Installation License :
- January/10 - June/11 (18 months);

Works:
- July/11 - October/12 (16 months);

Operation/Trade:
- November/12 - October/30 (grant's end– ANEEL).



ETA Guaraú dissipation basin

Energy potence:

Guaraú intake: 4.2 kW

Cascata: 2.8 kW

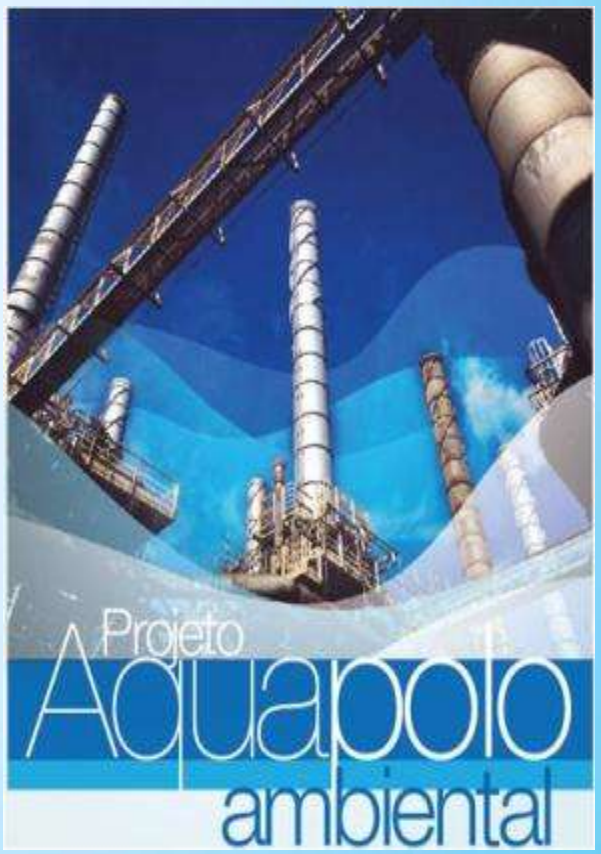
Reclaimed water

Aquapolo Ambiental Project

The largest project of wastewater reuse in Brazil and the 4th largest in the world ...

EXPAND the use of water reuse in the INDUSTRY

ENABLE the water supply needed to the EXPANSION
of capacity of the ABC petrochemical complex



- ✓ **Supply capacity: 1,000 l/s**
- ✓ **Enough to supply a city of 600 thousand**
- ✓ **Pipeline of 17 km – Ø 900 mm**
- ✓ **Total investment: US$ 182 million**
- ✓ **Start-up: August/2012**

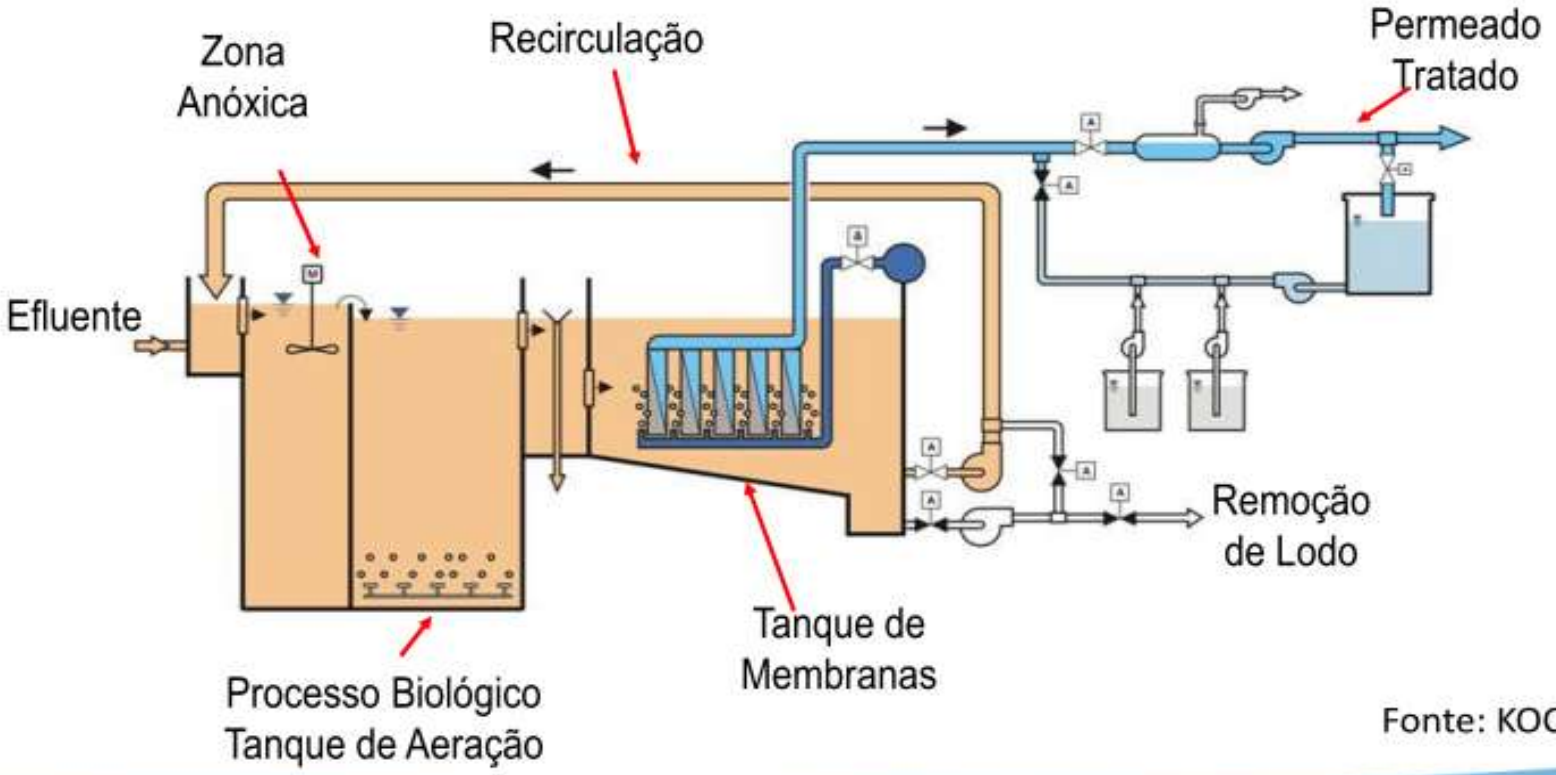
Aquapolo project: TMBR (UF + RO)

- activated sludge for tertiary treatment;
- ultrafiltration membranes;
- Reverse osmosis for adjusting conductivity.

Febrero 2013

Aquapolo Ambiental S.A.

- EPAI



Fonte: KOCH

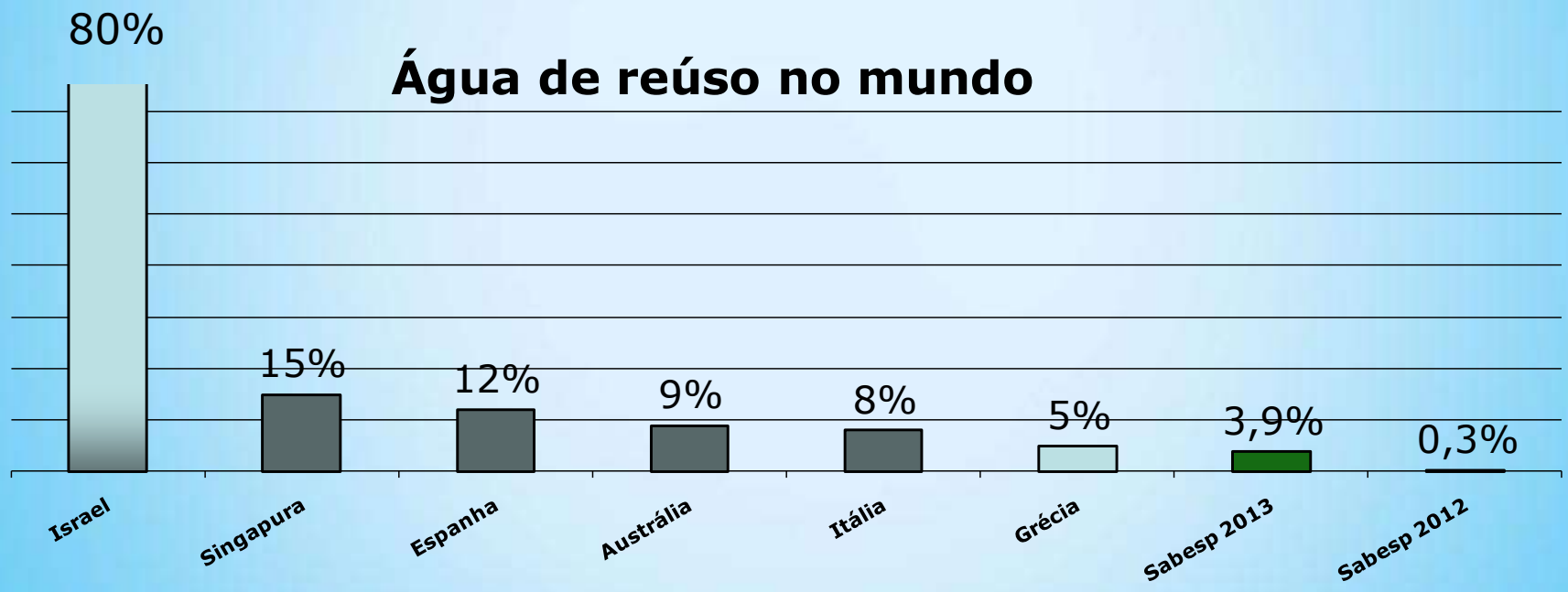
The 1st Braz. Activated Sludge WWT plant (1937) now is a reclaimed water site

Granular filtration for reclaimed water attending a textile industry with 40,000 m³/month

Leap on reclaimed water production in 2012 due to Aquapolo

Supply in 2012: 145 mil m^3/month – 55 customers

Reclaimed water / Treated sewage

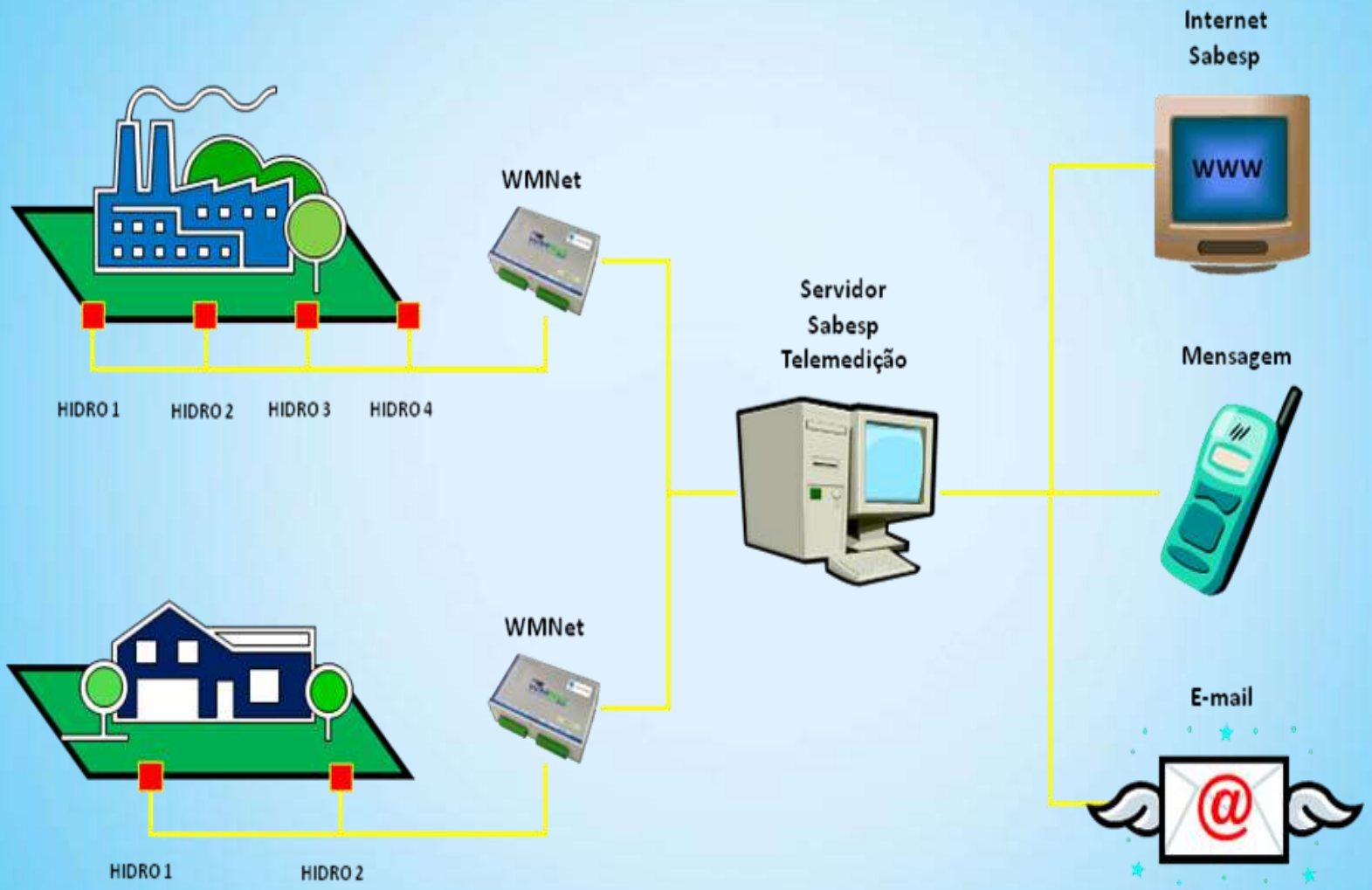


Other reclaimed water projects

- SANASA (Campinas, SP) has started up in 2012 an MBR WWT plant for 180 L/s – planned reuse at Viracopos int. airport;
- CEDAE & Foz & GE Water have agreed to build an MBR facility at Alegria WWT plant for 1500 L/s (final phase) for supplying a new petrochemical complex in Rio (Comperj/Petrobras);
- Sabesp has supplyed 2000 m^3/month for the earthworks of new S. Paulo stadium for 2014 World Cup (humidity adjustment) and will attend its domestic use and field irrigation (2000 m^3/month) through a new facility adopting UF with ceramic membranes;
- S. Paulo's municipality plans a large renewing project for a neighborhood in old Centre offering reclaimed water by a network ring (NovaLuz Project);
- New uses under negociation: reuse water for washing the subway cars from S. Paulo's Tube;
- New standard allows reuse water from preparing non structural concrete and for curing;
- Reuse water is beggining to be adopted for the sludge of tunnel perfurations and pie jacking.

Partnership with Fraunhofer Inst. for getting autofuel (methane) from biogas

Telemeasurement for watermeters



Telemeasurement: possible to get data from all utilities (water, electricity and gas)

Enclosure of anaerobic ponds and biogas burnir

Flat covers currently in development.

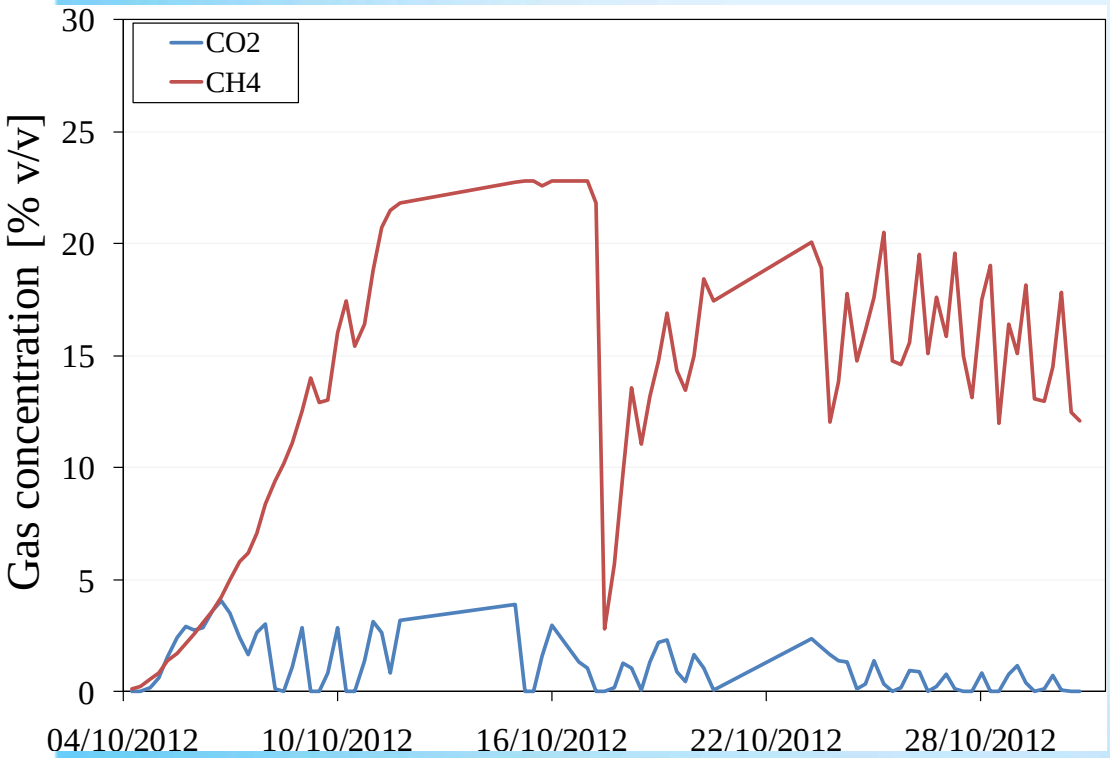
WWT Auriflama plant

WWT Silveiras plant

WWT Inúbia Paulista plant

Wastewater treatment plant, São Paulo, Brazil

26 days | 107 data points



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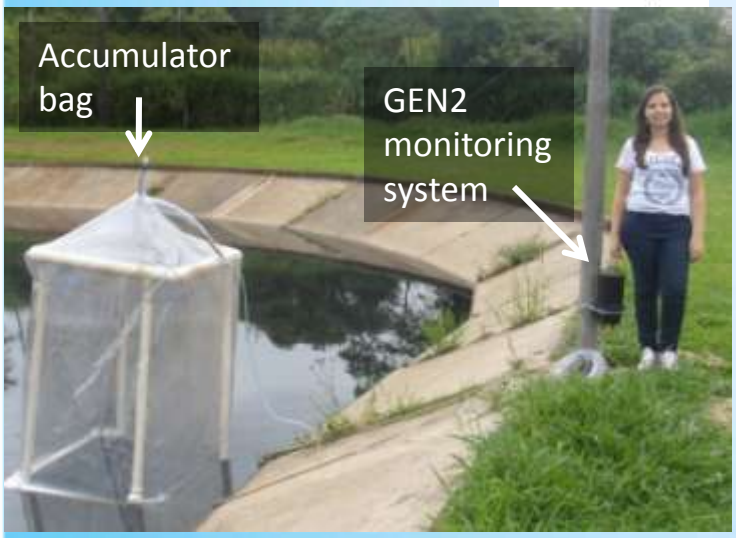
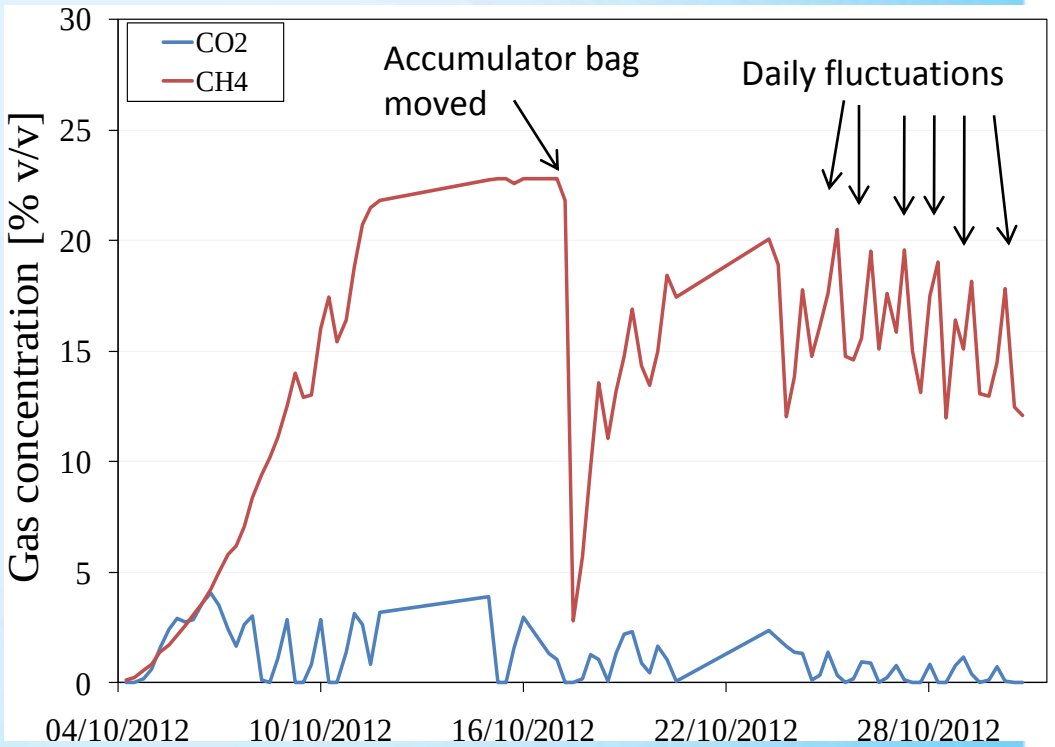
Brazil Deployment

Aim:
Determining surface emissions from wastewater treatment plant lagoon





Thank you!

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Sites: **www.abes-dn.org.br**
www.abes-sp.org.br