

## 9. Petrópolis: biological waste-water treatment



**Type:** multi-stakeholder

**Region:** southeast

**State:** Rio de Janeiro

**Biome:** Atlantic Rainforest

### City of Petrópolis

**Population:** 305 687 (estimated 2018 <sup>106</sup>)

**Area:** 776.6 km<sup>2</sup>

**Elevation:** 809 m <sup>107</sup>

**Coordinates:** 22.505000 S / 43.178611 W

**MHDI:** 0.745 (2010) <sup>108</sup>

### Context

Petrópolis is located about 70 km from the city of Rio de Janeiro. It is an important destination in the mountain region known as the Imperial City, named after Emperor Dom Pedro II who used to spend summer in the hills because of the more pleasant climate. It is an important historic site, with many tourist attractions, and is well known as a gourmet and nature-oriented destination because of its surrounding conservation units with impressive and vulnerable landscapes. The city has 82.1 % <sup>109</sup> of its waste water treated, which is higher than the national average of sanitation treatment of 44.92 % <sup>110</sup>. In the census of 2010, 25 117 people lived in subnormal housing (slums), mainly in vulnerable areas prone to floods and landslides.

<sup>106</sup>. <https://cidades.ibge.gov.br/brasil/rj/petropolis/panorama>

<sup>107</sup>. <https://www.geografos.com.br/cidades-rio-de-janeiro/petropolis.php>

<sup>108</sup>. <https://cidades.ibge.gov.br/brasil/rj/petropolis/panorama>

<sup>109</sup>. <https://cidades.ibge.gov.br/brasil/rj/petropolis/panorama>, accessed: 2017

<sup>110</sup>. <http://www.tratabrasil.org.br/saneamento/principais-estatisticas/no-brasil/esgoto>, accessed: 5.8.2018.

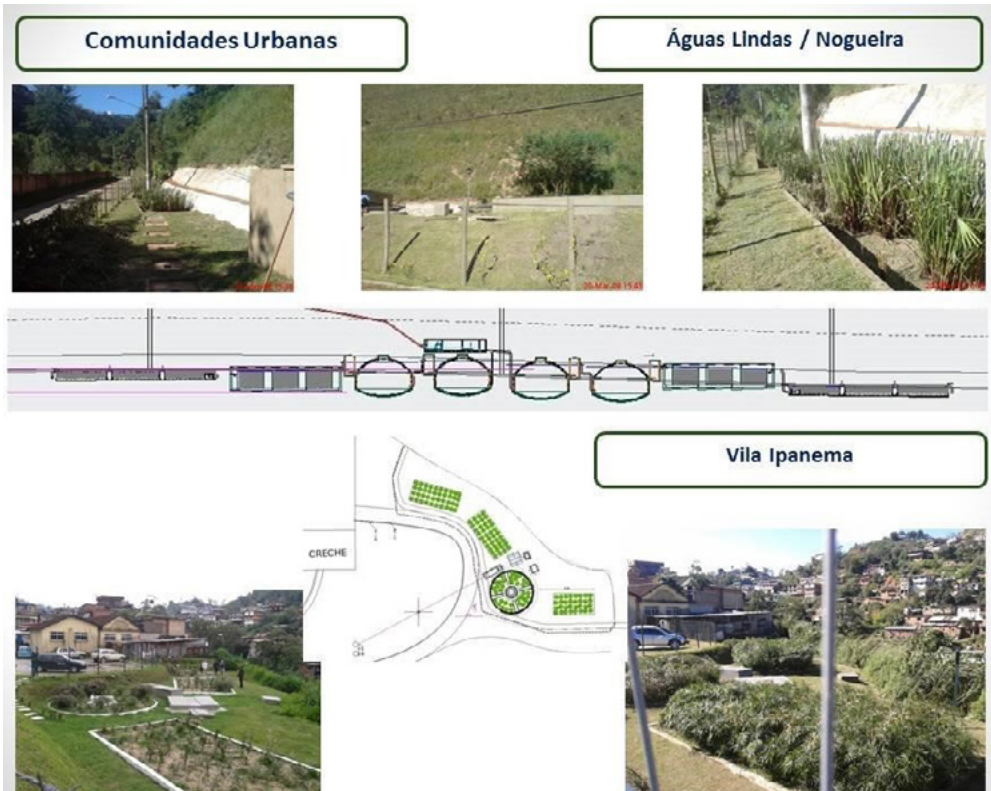


Figure 58. Waste-water treatment system and implementation images in different locations in Petrópolis.

## Challenges

Difficult access to treat waste water in the high and steep hills, where low-income people lived in unplanned dwellings. In many areas, sewage was discharged directly into the watercourses.

## Objectives

The aim of the micro waste-water treatment with biodigester and wetlands for depuration was to clean waste water, to reduce energy demand, and to use biogas.

## Actions

The decision of the water company was to implement NBS with biodigestors and built wetlands to treat the waste water locally and improve river water quality.

The biodigester is partially made with recycled materials, such as old tires and plastic bottles.

Ten neighbourhoods in Petrópolis already have implemented NBS to treat their waste water: Quarteirão Brasileiro, Vila Rica, Córrego Grande, Vila Ipanema, Nogueira, Siméria, Bonfim, Independência, Morro do Gavião e Caxambu.



Figure 59. Nature-based solution to treat waste water: biodigester and built wetland in Vila Ipanema, Petrópolis.

## Stakeholder involvement

The Environmental Institute, an NGO headed by the architect Jorge Pires, who is an expert on waste-water treatment has extensive experience in designing nature-based water treatment systems uses biologic-based technology. The private water company Águas do Imperador educated and trained local residents who participated in the implementation and are co-responsible for managing and maintaining the systems.

## Outcomes

Waste-water treatment plants based on NBS are five times less expensive than conventional plants and do not require energy input. They are effective, as the effluent that goes back to the watershed is up to 90 % cleaner. They are socially aware as it was decided not to charge low-income residents for waste-water treatment. Furthermore, biogas is used in kindergartens and by the community.

These plants recycle and reuse water, organic

## Success factors

The city had to bring its sanitation in line with federal legislation and received funds to implement the projects to protect the Paraíba river watershed, which provides water for a large population in the state of Rio de Janeiro.

## Implementation

The first plant began operating in 2002. Ten plants are in operation nowadays, thanks to a collaboration between Águas do Imperador, the city of Petrópolis, the Environmental Institute of the state of Rio de Janeiro (INEA) and the Environmental Institute (NGO).

matter present in the sewage and methane gas.

The water company invested in environmental education programmes for local residents.

There was an improvement in the environmental and aesthetical local conditions, as in the case of Vila Ipanema (see image above).

## Lessons learnt

Nature-based waste-water treatment is economically viable, ecologically reliable and benefits the neighbourhood and its residents. The NBS waste-water plants have received awards and have attracted visitors from other cities and countries to learn from their experience, including staff from the World Bank.

Residents must be educated and participate in the process to achieve a shift in the paradigm of traditional waste-water treatment.

Topography is a barrier to transferring sewage to a distant conventional treatment plant, so this is the only option for many cases in the mountainous region.

## Contact

Jorge Pires Gaiofatto  
jorge@arquiteturapositiva.eco.br

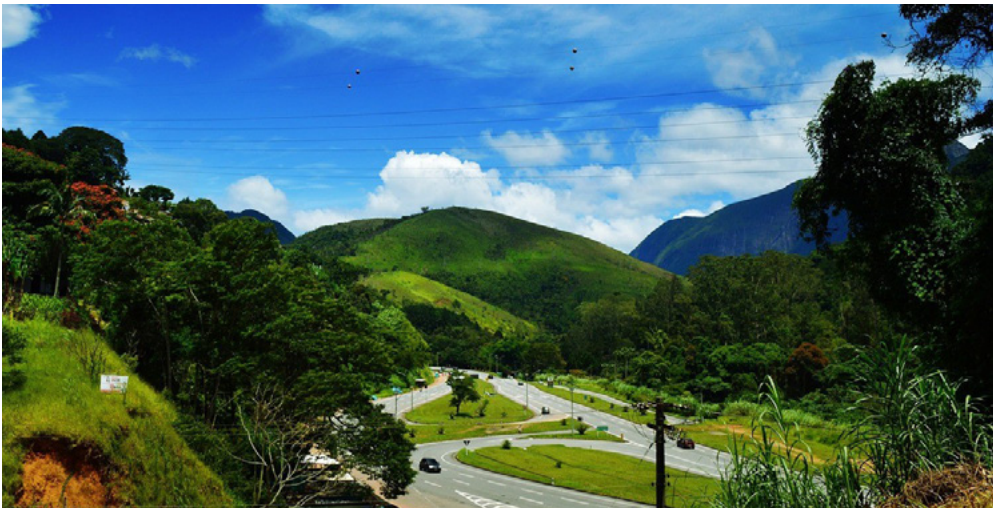


Figure 60. Petropolis is located in a mountainous region of the state of Rio de Janeiro.

## Selected References

<http://abconsindcon.com.br/revista-canal/os-biodigestores-da-aguas-do-imperador/>  
<http://www.petropolis.rj.gov.br/pmp/index.php/imprensa/noticias/item/3074-prefeitura-e-%C3%A1guas-do-imperador-inauguram-biodigestor-no-quarteir%C3%A3o-brasileiro>  
<http://diariodepetropolis.com.br/integra/aguas-do-imperador-conquista-mais-um-premio-por-praticas-socio-ambientais-sustentaveis-123215>