

Executive summary: *Sustainable Implant, Erasmusveld*

The City Development Office of Den Haag's ambition is for Erasmusveld to be the most sustainable neighborhood in the Netherlands. The site, 51 hectares in the southwest of Den Haag, has a strong green character and is currently occupied by allotment gardens and sports fields. From 2012-2020, 750 homes and a small number of offices will be constructed with a variety of urban typologies. Conventional 20th century infrastructures (electricity, heat supply, sanitation, solid waste management, transportation) do not meet the planners' ambitions of 100% local and renewable energy and climate neutrality. A decentralized infrastructure network, formulated by the Sustainable Implant¹ concept, was investigated to empower Erasmusveld socially, environmentally, and economically.

Constructive research (literature review, case studies, expert interviews and design) resulted in the Sustainable Implant as a community center, infrastructure service hub, and processing device^{FIG1}. The operative ecosystem recirculates energy and nutrients from "waste" and captures primary resources (sun, wind, rain). There are eight physical components to the system:

Electricity microgrid	The microgrid balances supply-demand curves by managing the demand with smart meters and administers a fair price for renewable electricity.
Community Center	The community center is an open-plan vessel for inhabitants' needs, whether concerning planning, recreation, education, small industry, politics or art.
Vacuum sewer	The vacuum sewer creates a source-separated water cycle that is essential for optimally processing wastewater to recover nutrients and biogas.
Sanitation & resource recovery	The device processes wastewater and kitchen waste to produce biogas, struvite (fertilizer), and sanitized water for irrigation.
Biocycle Glasshouse	The biological cycle is completed by growing food using by-products of the sanitation processes and the composting of woody organic material.
Neighborhood heat network	Heat from renewable sources (predominantly solar thermal) is circulated for space warming and hot tap water with seasonal storage in aquifers.
Retourette	Recycling is improved through a convenient drop-off location for separated materials and reuse of non-waste items (i.e. clothes, books, furniture).
Electric Vehicle sharepoint	The centralized parking garage allows for car-free zones and reduced car-dependence while facilitating a car sharing program with alternative fuels.

The neighborhood ecosystem is formed by integrating the inputs and by-products of the components, which are spatially optimized under one roof. A compact and flexible infrastructure "ribbon" between the buildings and the Sustainable Implant encapsulates the heat network, vacuum sewer, electricity and telecom wires; re-imagining infrastructure as a tangible landscape to reinforce stewardship and connectivity.^{FIG2}

Economically, the infrastructure network is owned, operated and maintained by a local utility service company (termed the Erasmusveld Energy BV), which would reduce inhabitants' utility costs by 10-20%² through efficiencies gained by integration and would create administration and caretaking jobs. Inhabitants have the right to be shareholders in the company. The infrastructure network's value is retained in the community, and inhabitants vote on how accumulated funds are reinvested.

Compared to a conventional neighborhood by four indicative cycles (carbon, phosphorus, water and energy), the Sustainable Implant improves urban metabolism. Notably, the infrastructure of renewable electricity, heat network and resource recovery from organic material leads to a carbon-negative balance, making Erasmusveld the first carbon-negative neighborhood in the Netherlands. The Sustainable Implant also fulfills twenty-one established criteria, including *Optimizing collection and transport*, *Equal or more comfort*, *Equal or more ease of use*, and *Similar costs*.

1 The Sustainable Implant concept was introduced in Arjan van Timmeren's *Autonomy and Heteronomy* (2006).

2 According to case studies: InfraNova GmbH of Flintenbreite, Germany; neighborhood wastewater purification in Kolding, Denmark; and local energy companies DEVO BV of Veenendaal, NL and Deva BV of Vaartsche Hoek, NL.

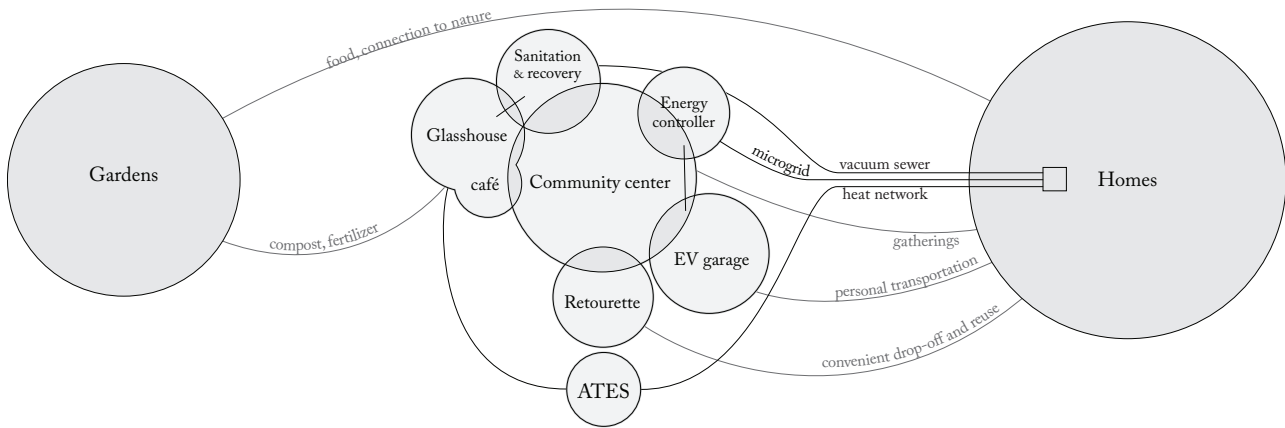


Figure 1. The core functions of the Sustainable Implant.

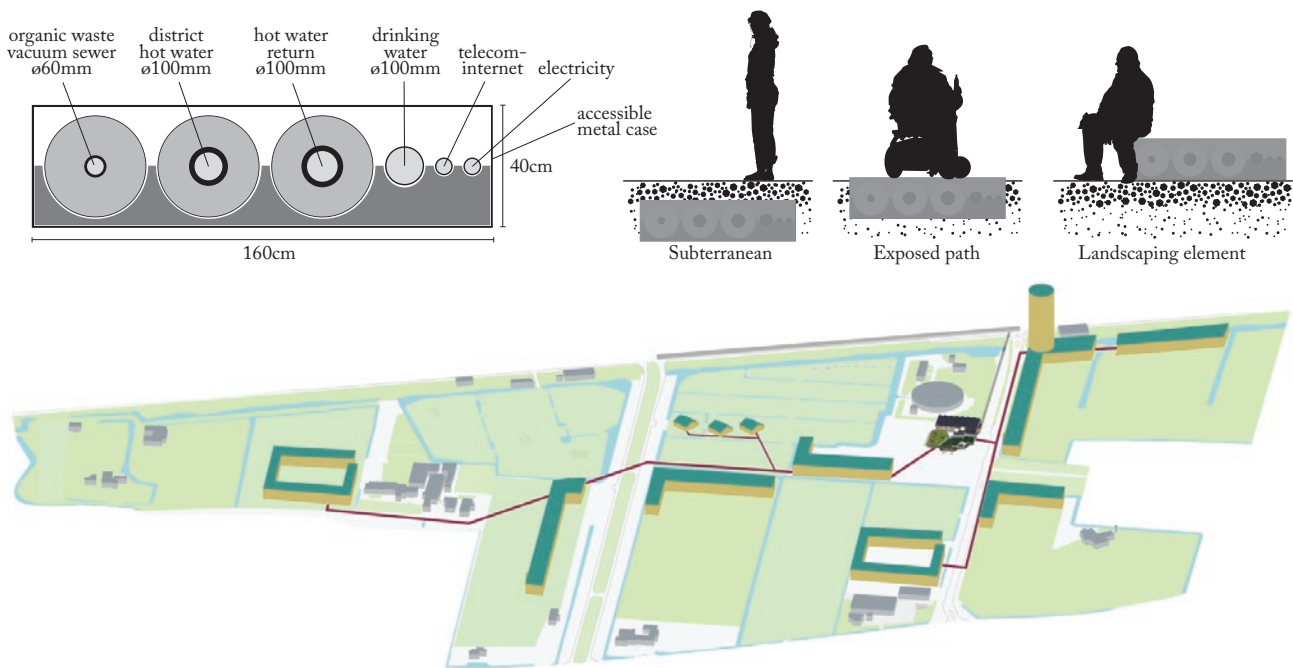


Figure 2. Above, a cross-section of the infrastructure case with examples of use in the landscape. Below, a projection of Erasmusveld with the Sustainable Implant as the decentralized infrastructure hub and processing device.