M2

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SPATIAL PLANNING and ENERGY for COMMUNITIES IN ALL LANDSCAPES

Pianificazione Urbanistica ed Energia

MODULI PER LA FORMAZIONE A LUNGO TERMINE

CeNSU Centro Nazionale Studi Urbanistici

Co-funded by the Intelligent Energy Europe Programme of the European Union

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Pianificazione Urbanistica ed Energia

1. Le azioni possibili
2. Progettare la città sostenibile (1/2)
3. Progettare la città sostenibile (2/2)
4. Strumenti per le trasformazioni urbane low carbon
5. Contenimento di suolo e rigenerazione urbana

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Pianificazione Urbanistica ed Energia

3 **Progettare la città sostenibile (2/2)**

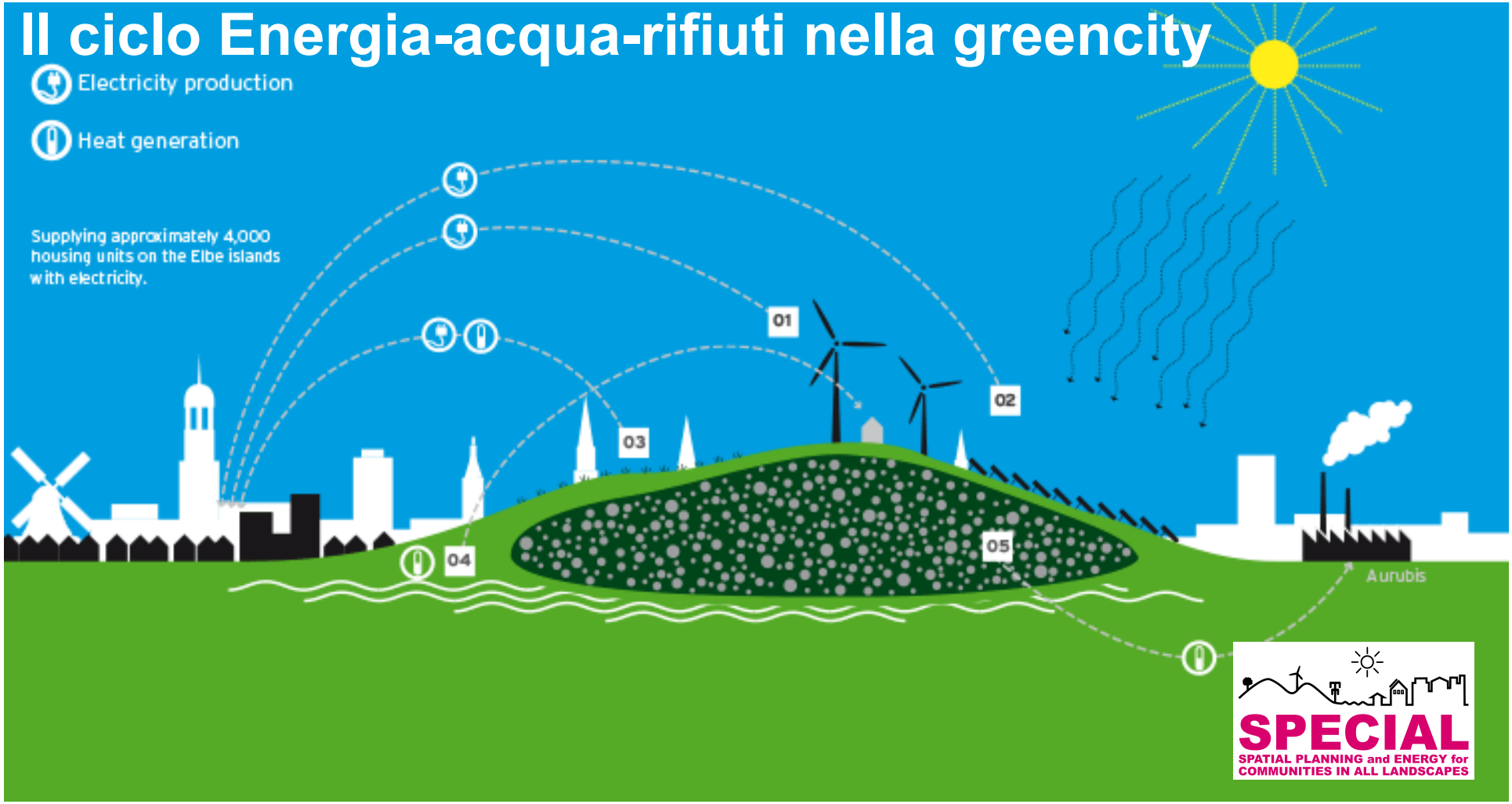
2 Il ciclo energia, acqua, rifiuti nella green city

CeNSU Centro Nazionale Studi Urbanistici

Co-funded by the Intelligent Energy Europe Programme of the European Union

Tecniche di pianificazione per la riduzione del consumo energetico

Il ciclo Energia-acqua-rifiuti nella greencity



Freiburg-Vauban (Germania)

Acque piovane → IRRIGAZIONE

Acque nere + rifiuti organici → BIOGAS

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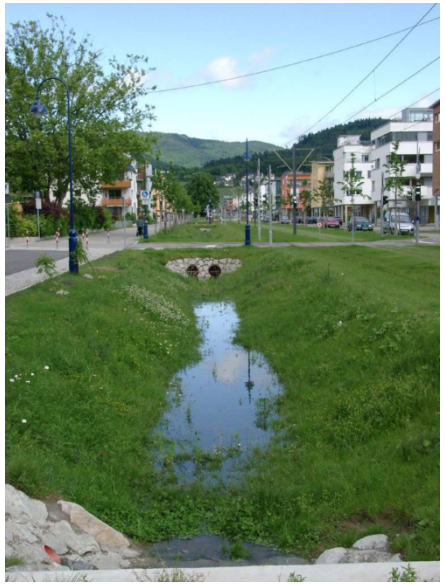
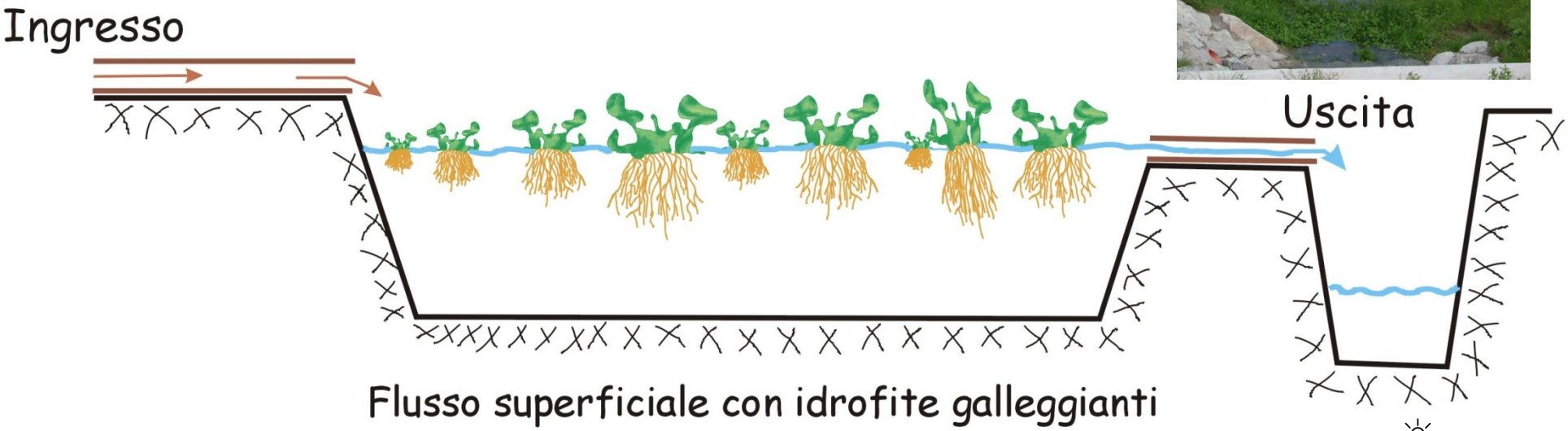
Freiburg-Vauban (Germania)



Acque grigie → FITODEPURAZIONE



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Augustenborg-Malmö (Svezia)

EKOSTADEN AUGUSTENBORG

- Towards a Sustainable Neighbourhood

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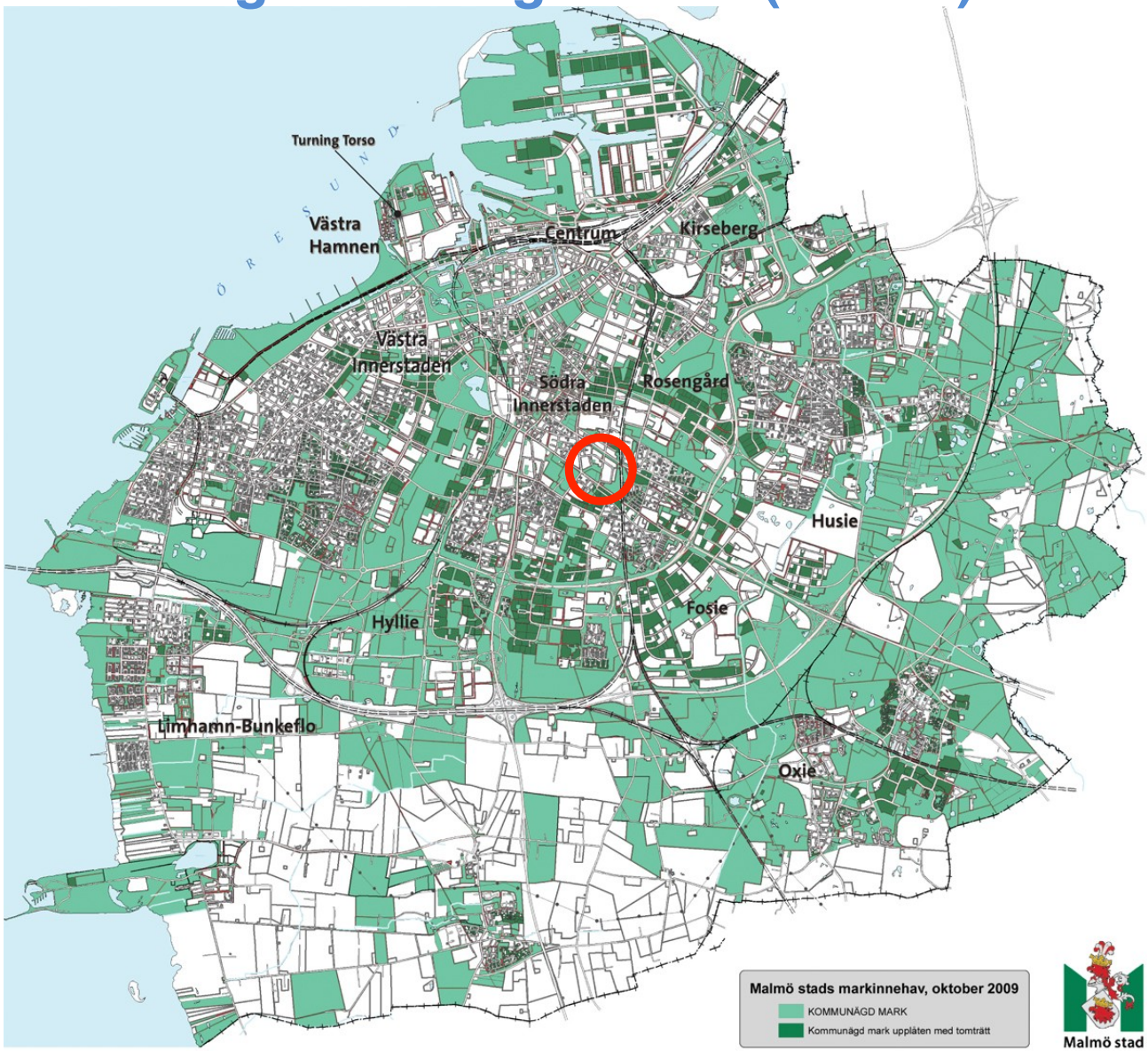

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Augustenborg-Malmö (Svezia)
RETROFITTING

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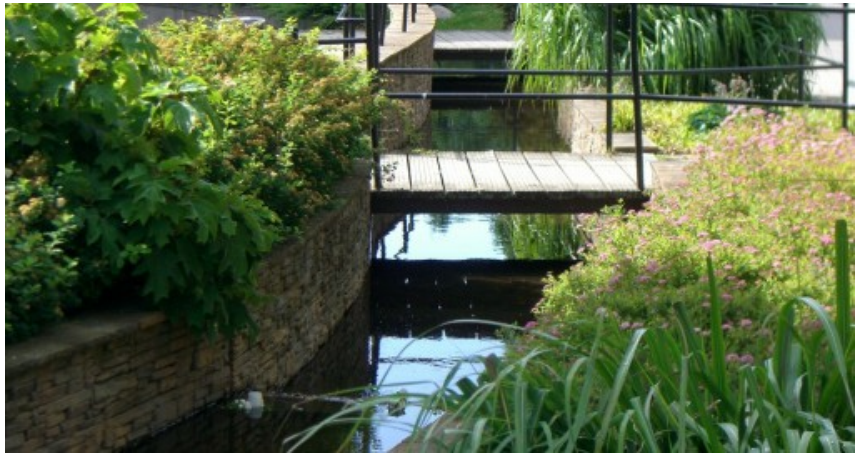
Augustenborg-Malmö (Svezia)
RETROFITTING



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Augustenborg-Malmö (Svezia)
RETROFITTING

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Copenaghen- Ørestad (Danimarca)

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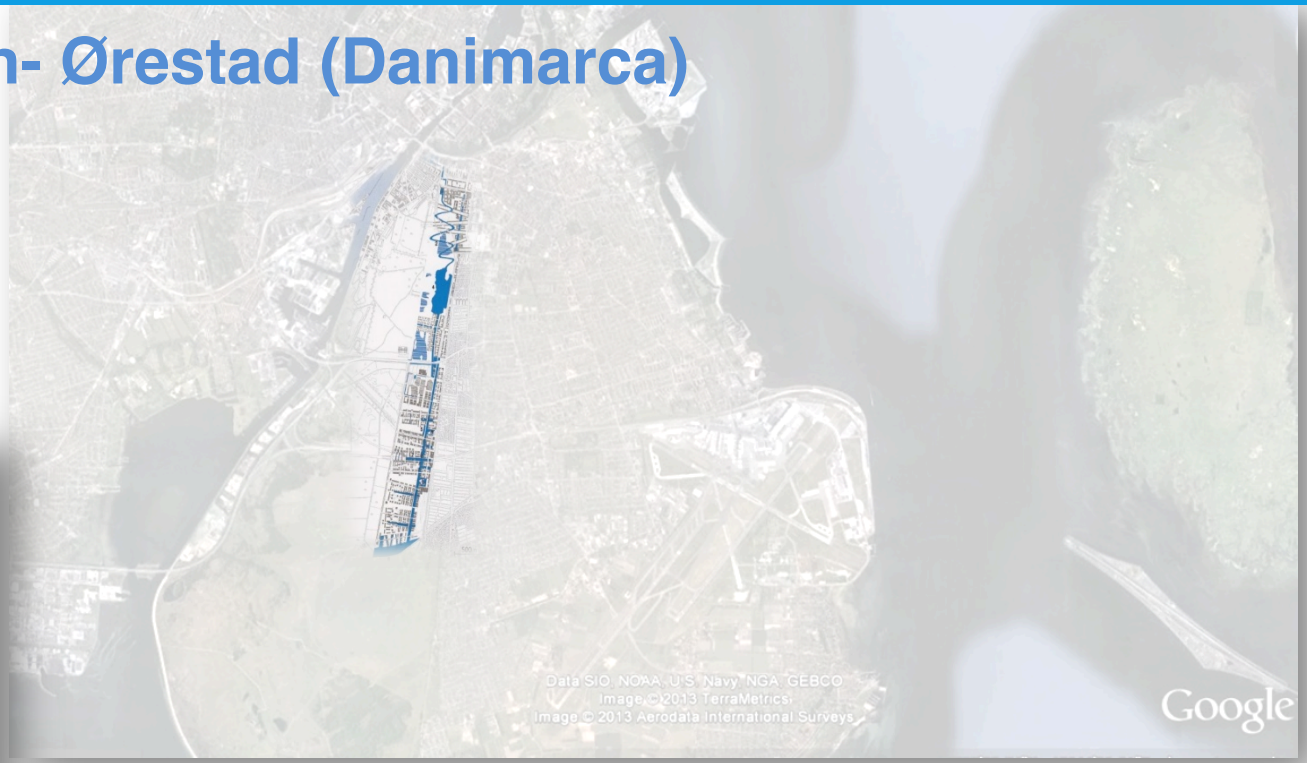
Copenaghen- Ørestad (Danimarca)



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Copenaghen- Ørestad (Danimarca)

I canali principali che attraversano il quartiere sono:

- ***Emil holms Canal che attraversa longitudinalmente Ørestad Nord.***
- ***Landscaped Canal che attraversa la parte occidentale di Ørestad Nord e si snoda nei prati di Amager Fælled.***
- ***Urban Canal che scorre parallelamente alla rete della metropolitana attraversando il quartiere centrale, Ørestad City .***
- ***Urban canal continua fino al quartiere di Ørestad Sud.***

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Copenaghen- Ørestad (Danimarca)

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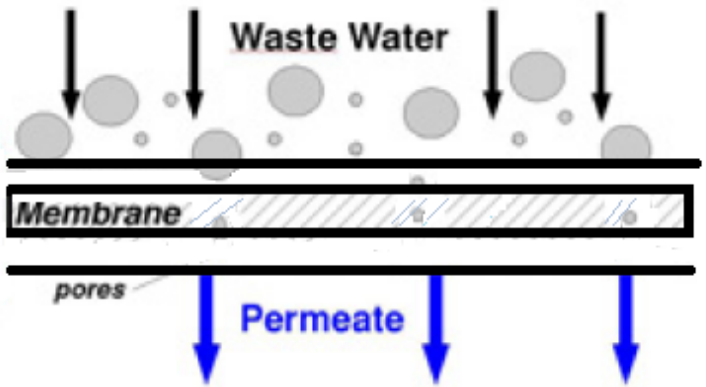
Copenaghen- Ørestad (Danimarca)

Impianto "Dual porosity filtration "



materiale in nylon più poroso generalmente di pochi mm.

In mezzo si ha una membrana che filtra l'acqua in modo tale da costringere i solidi verso il basso

L'ultimo strato costituito nuovamente da materiale poroso nel quale si andranno a depositare i solidi sospesi, tra cui si può includere polvere, gomma e asfalto, e in questo modo essere rimossi dall'acqua.

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Copenaghen- Ørestad (Danimarca)

Vantaggi del "Dual porosity filtration "

Nessun costo a livello di energia ,perché l'acqua entra nel sistema seguendo il suo percorso naturalmente.
L'impianto non si può ostruire grazie alla presenza di diversi strati.
Nessun utilizzo di prodotti chimici.

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Western Harbour-Malmö (Svezia)

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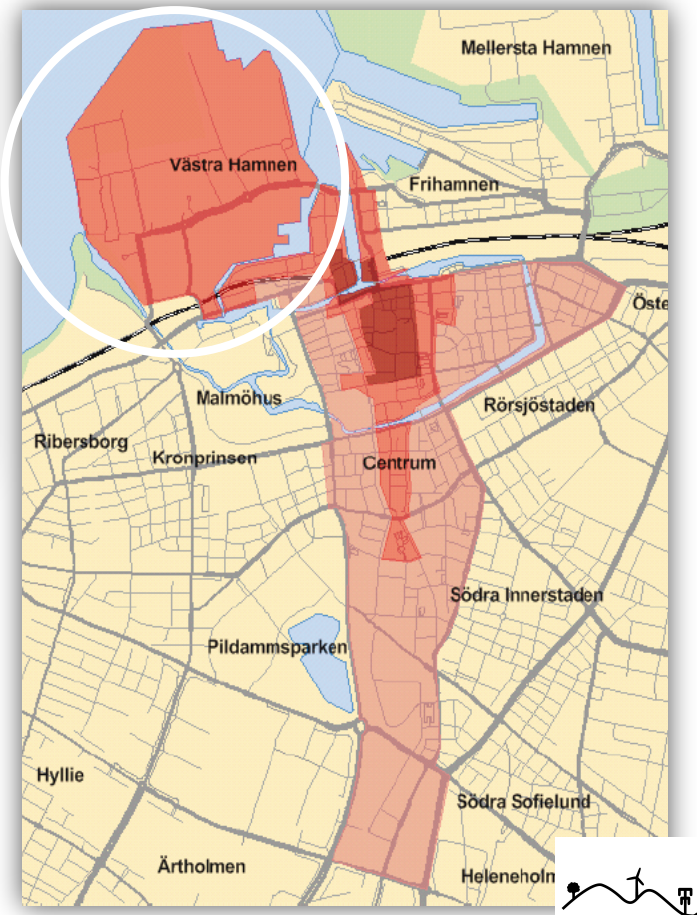
Western Harbour-Malmö (Svezia)



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Western Harbour-Malmö (Svezia)

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Western Harbour-Malmö (Svezia)

Offshore Wind Park

The wind power plant BOEL supplies power to the residential area in the Western Harbour. The wind power park at Lillgrund is the largest wind power investment in Sweden to date.

With its 48 turbines, the park is the third largest offshore wind park in the world, and supplies 60,000 homes with a power production reached 3.4 million KWh during the first quarter fo 2008

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Teleriscaldamento a Brescia

In Brescia, the choice of district heating, already starting from the 1970's, has continued to make an important contribution to the containing of atmospheric pollution in the city. Over 70% of the population of the Brescia Municipality live or work in district-heated environments.

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District Heating - Brescia

Fonti differenziate

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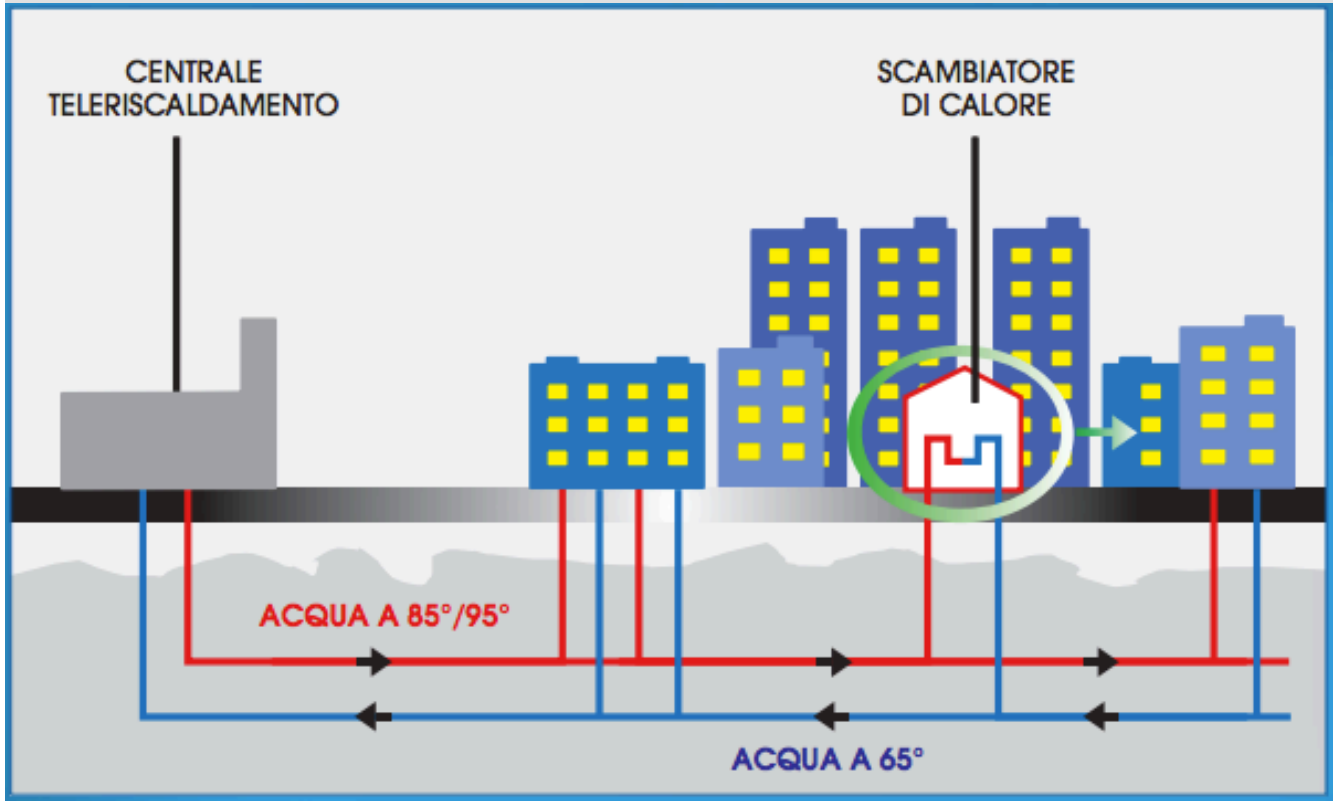
Teleriscaldamento a Brescia



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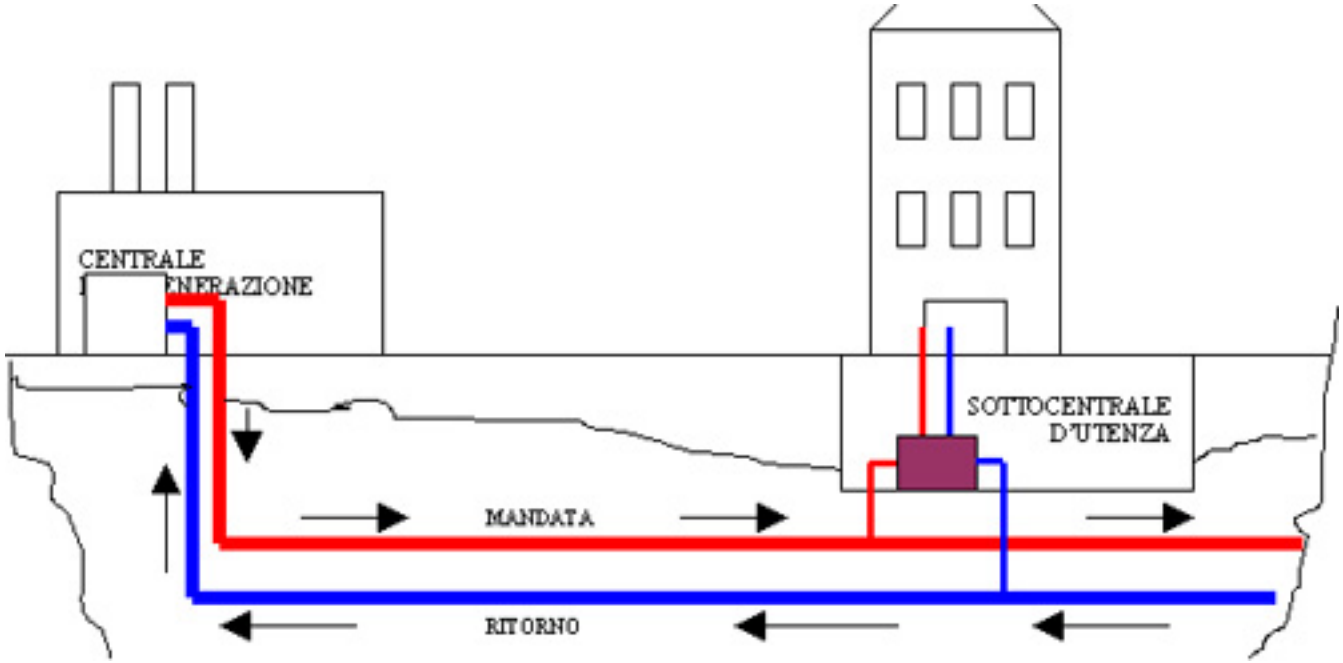
Teleriscaldamento a Brescia



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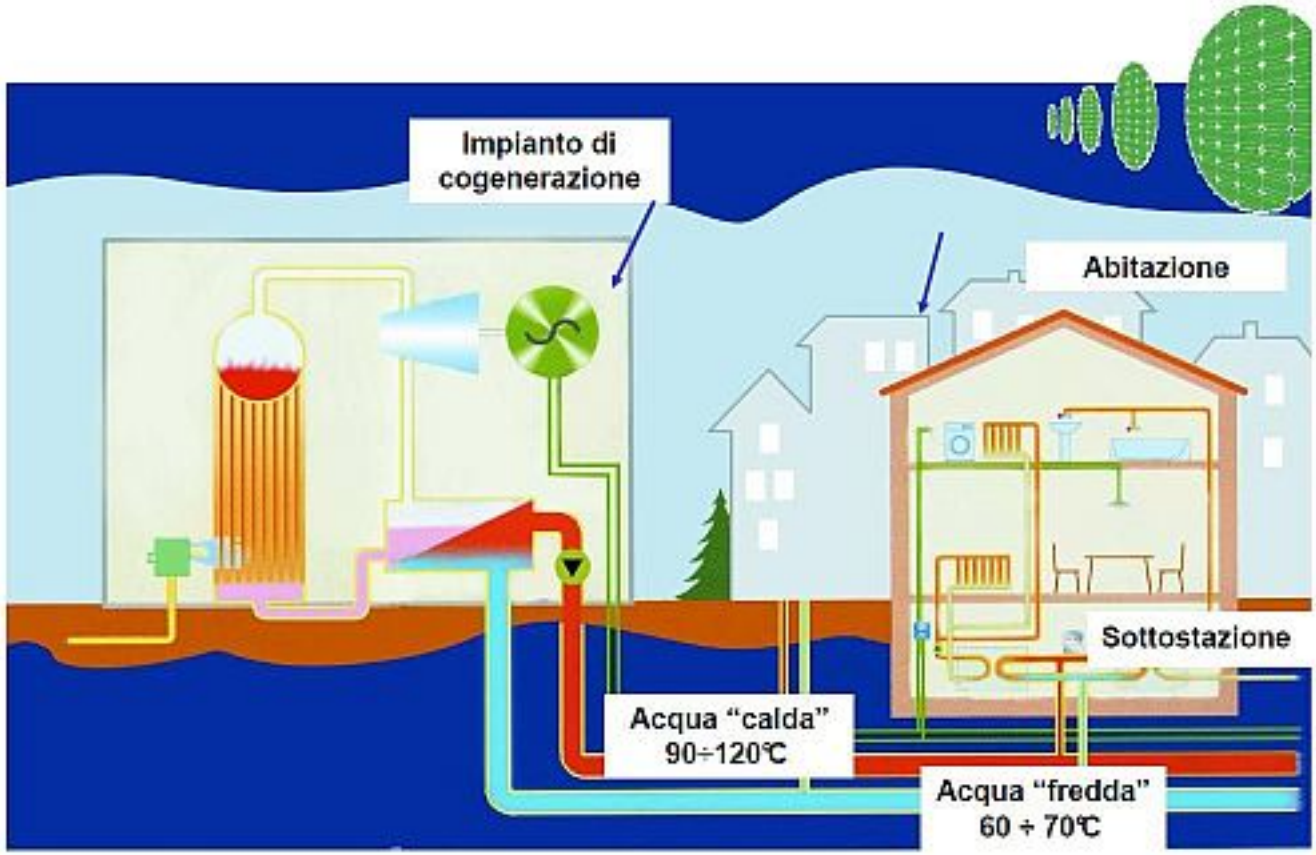
Teleriscaldamento a Brescia



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Teleriscaldamento a Brescia

Centrale La Marmora

1972

The project born in 1972, with the first pilot experiment, consolidating itself over the years with a continuous development of the network and with the starting up of new production plants, always realized with the best technology available in the market and with particular attention to systems of combating and control of polluting emissions.

Teleriscaldamento a Brescia

Centrale La Marmora

1978

It was in 1978 that the first co-generation station was started up, Sud "Lamarmora", for the combined production of electrical energy and heat. Co-generation on a level with services provided, permits a primary saving in energy to the order of 20-30% compared to the separate production of electricity and heat. The station can be powered by different fuels, natural gas, and coal, also with a fuel mixture.

Teleriscaldamento a Brescia

1998

In 1998 the waste to energy plant came into operation, using as fuel solid urban waste. From this plant, able to burn 800 thousand tons of waste and biomass annually, it is possible to obtain annually 528 million electric kilowatt hours and 505 million kilowatt hours of heat with a saving of 150 thousand tonne oil equivalent

Consumo medio di energia

1 persona consuma 3KWh al giorno
1 famiglia consuma 10 KWh al giorno
1 famiglia consuma 3000 KWh/anno

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Teleriscaldamento a Brescia

2004 A further step forward was taken in 2004 with the completion of the plant with biomass powered design.

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Teleriscaldamento a Brescia

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BRESCIA DISTRICT HEATING – EXISTING SITUATION

>40 Mm3 heated volume

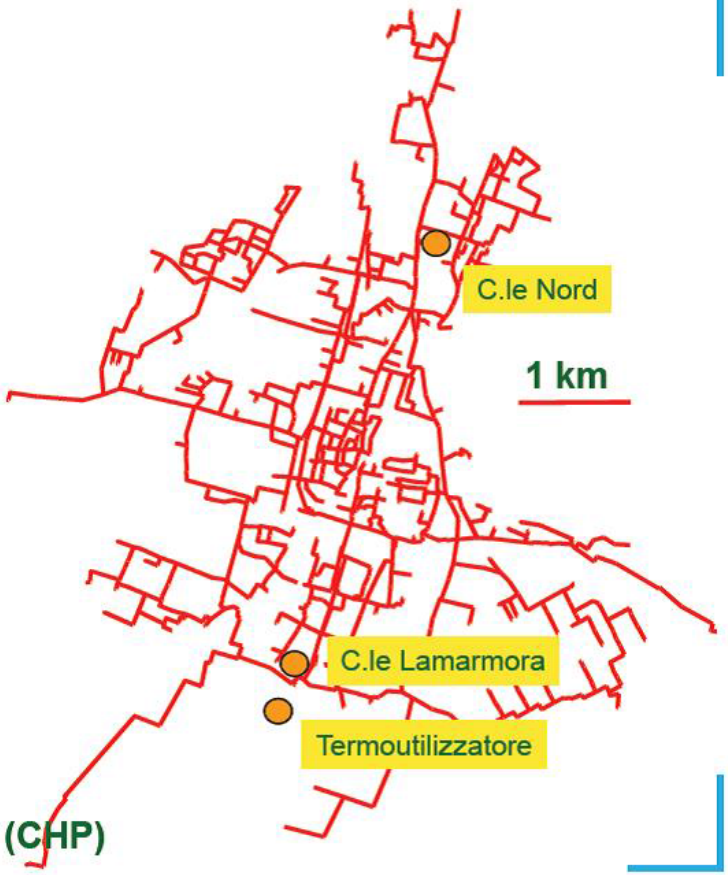
>620 km of double pipe

>20.000 connected buildings

>130.000 inhabitants supplied

695 MWt of installed power

223 MWe of electrical installed power (CHP)



620 km grid

Teleriscaldamento a Brescia

620 km grid

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Teleriscaldamento a Brescia

620 km grid

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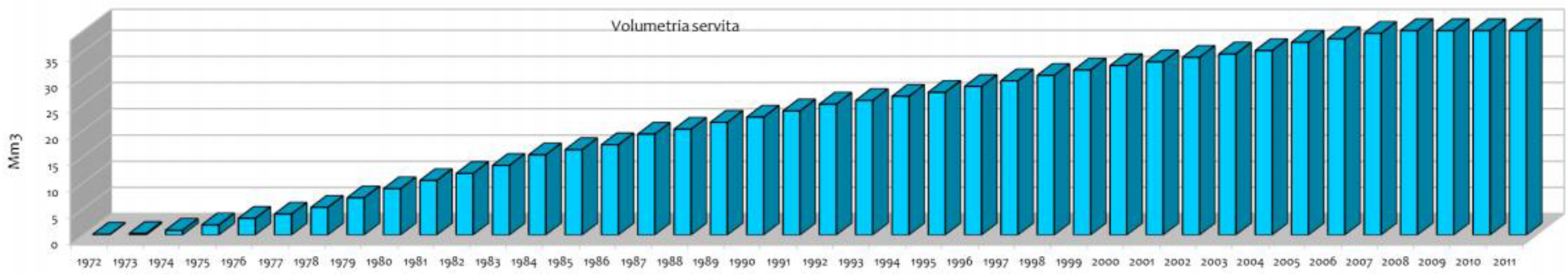
Teleriscaldamento a Brescia

The plant, which can burn on average 750,000 tonnes of waste and biomass per annum, can generate almost 600 million KW/h of electricity (the annual requirement of 200,000 households), and more than 800 million KW/h of heat (the remote heating requirements of more than 60,000 apartments). It does this with savings of more than 150,000 tep (tonnes petroleum equivalent), preventing the emission of more than 400,000 tonnes of CO2 – the same result that would come from the reforestation of more than 15,000 hectares of land (around twice the size of the Brescia municipal area)



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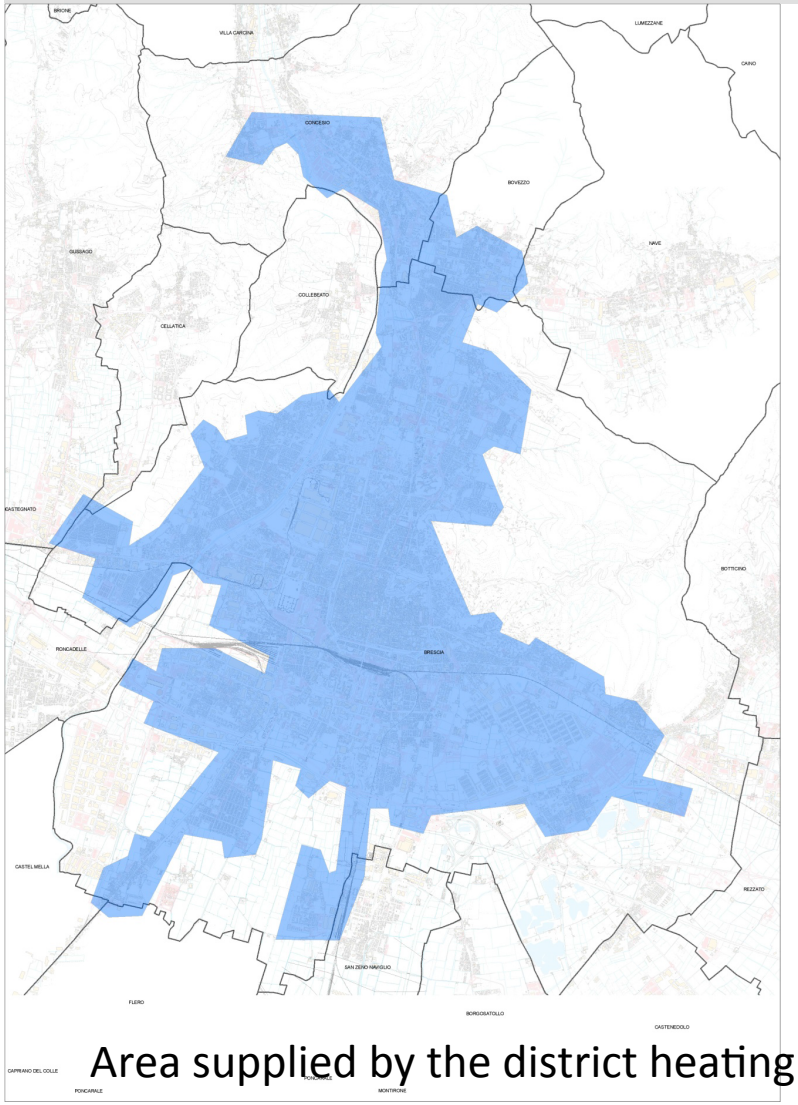
Teleriscaldamento a Brescia



Area supplied by the district heating network (www.a2a.eu).

The heat produced by waste to energy covers over 40% of the heating requirements of district-heated constructions. The district-heating network of Brescia goes beyond the municipal boundaries to serve as well a good part of the adjoining municipalities of Bovezzo and Concesio.

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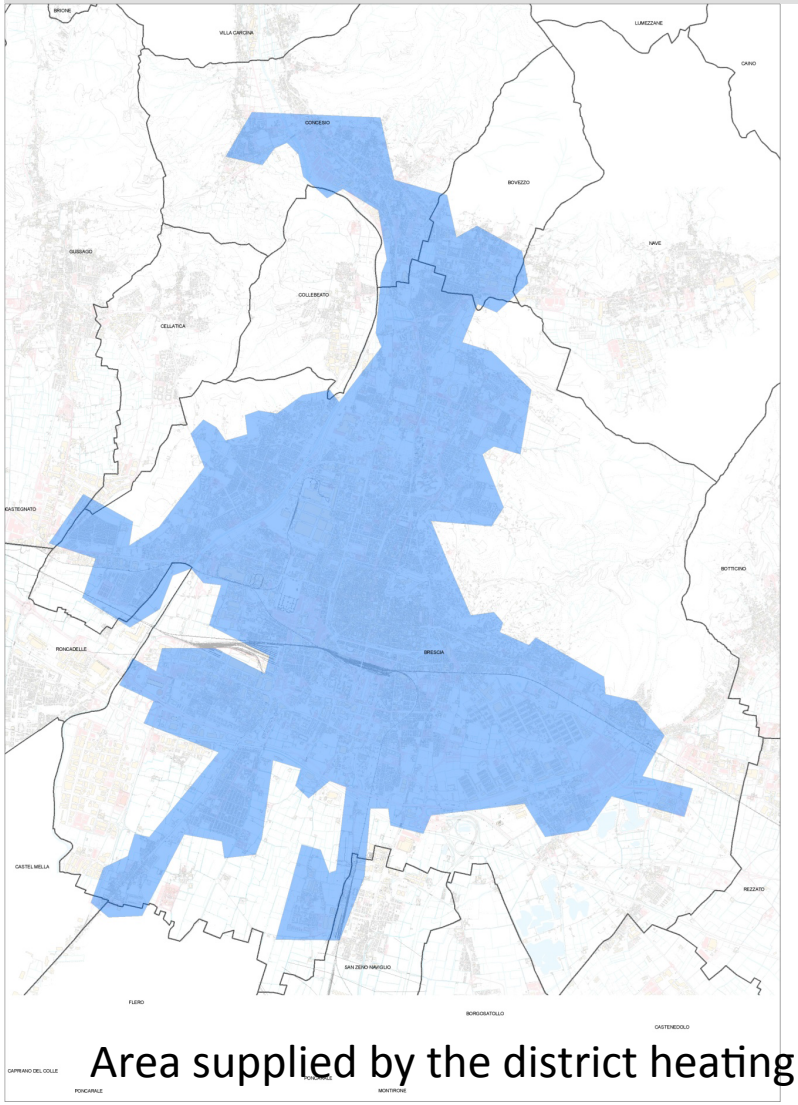
Teleriscaldamento a Brescia



Area supplied by the district heating network (www.a2a.eu).

At 31st December 2009 buildings for over 40 million cubic meters were connected but further developments and extensions of the network are expected to reach by 2020 the ambitious target of 45 million cubic meters.

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Teleriscaldamento a Brescia

1972 – Realization of DH network in Brescia 2 area

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Teleriscaldamento a Brescia

Early '80s – Realization of DH network in city center

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Teleriscaldamento a Castegnato (BS)

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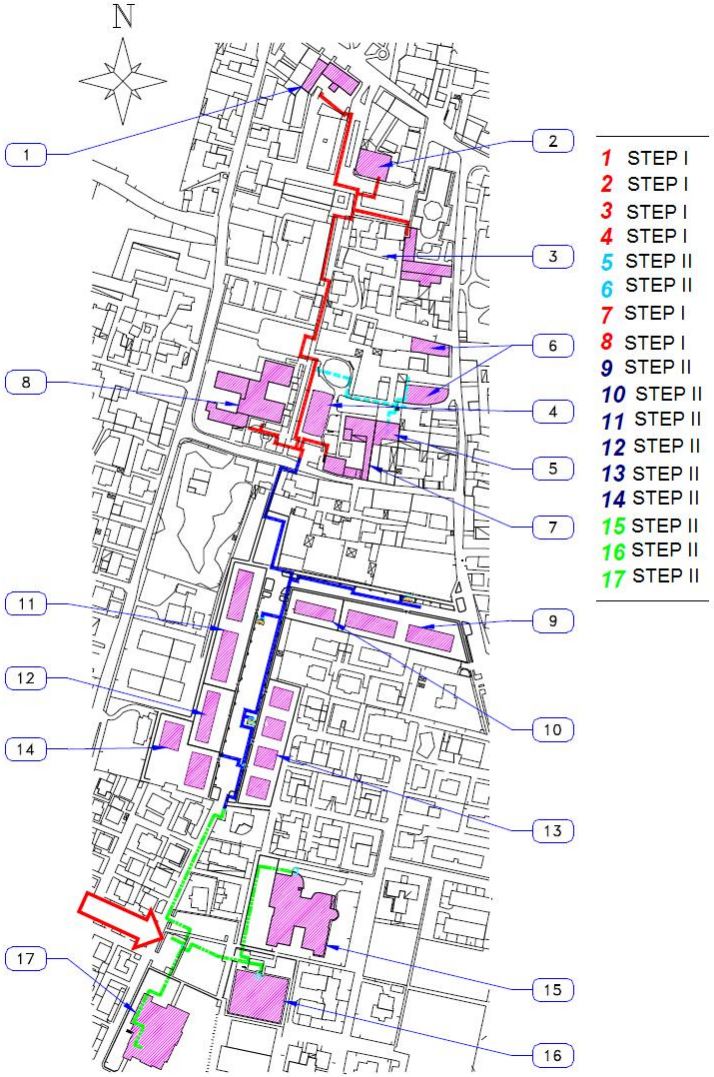
Teleriscaldamento a Castegnato (BS)



I Step (2007)

Implementation of the district heating network at the service of the public buildings in the northern area of the town

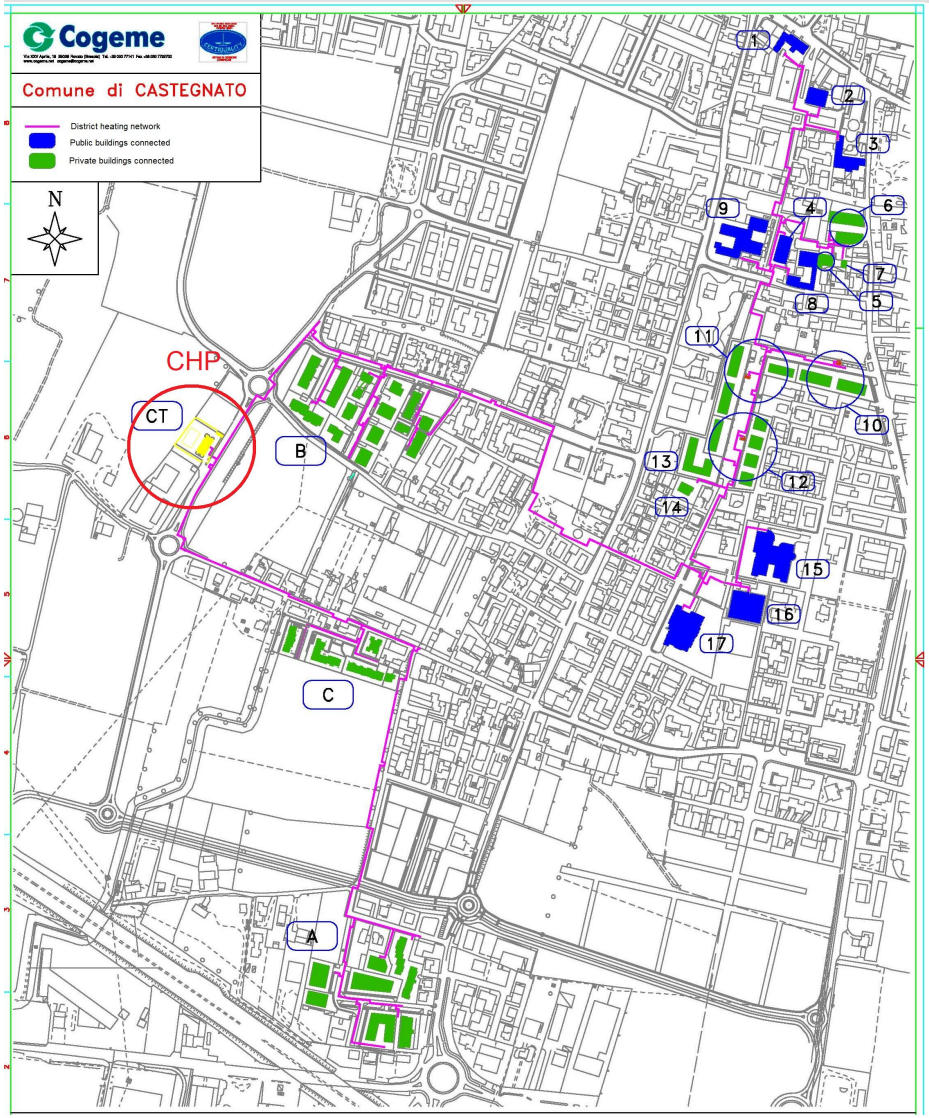
II Step (2008)

Implementation of the district heating network at the service of the public buildings in the southern area of the town and of a block of private houses close to them

III Step (2009/2010)

Connection of the network relatives to the step I and II to the site where the CHP plant will be built. Progressive connection of the new buildings realized in the development areas forecasted in the masterplan.

Teleriscaldamento a Castegnato (BS)



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Teleriscaldamento a Castegnato (BS)

Flow temperature: 85 °C
Backflow temperature: 60°C

natural gas consumed by the CHP
495,768 Smc
heat production of the CHP:
2,099,873 kWh
electrical production of the CHP:
1,740,186 kWh
electricity sold to the national grid: 1,661,620 kWh

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Table 1: Technical data.

	Residential	Tertiary	Industrial	Total
Heated Volume	61,715 m^3	51,100 m^3	-	112,815 m^3
Thermal Energy Provided	1,272 mWh	1,289 mWh	-	2,562 mWh

‘Solarpark’ su una discarica dismessa (Jena / Thuringia, Germany)

In July 2007 the city council launched an energy concept including a model for energy and climate protection

Binding Land use Plan Zone SO1 and SO2

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‘Solarpark’ su una discarica dismessa (Jena / Thuringia, Germany)

approximately 8 ha of the former domestic refuse landfill to the construction of the photovoltaic plant

Power capacity: 1.26 to 2.14 megawatt hours (yearly supply of electricity for at least 550 Jena households)

The distance between dwellings and solar plants is at least appr. 160 m.

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Kalasatama - Helsinki (Finlandia)

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KALASATAMA

Residential and Business District on the Waterfront

Kalasatama - Helsinki (Finlandia)

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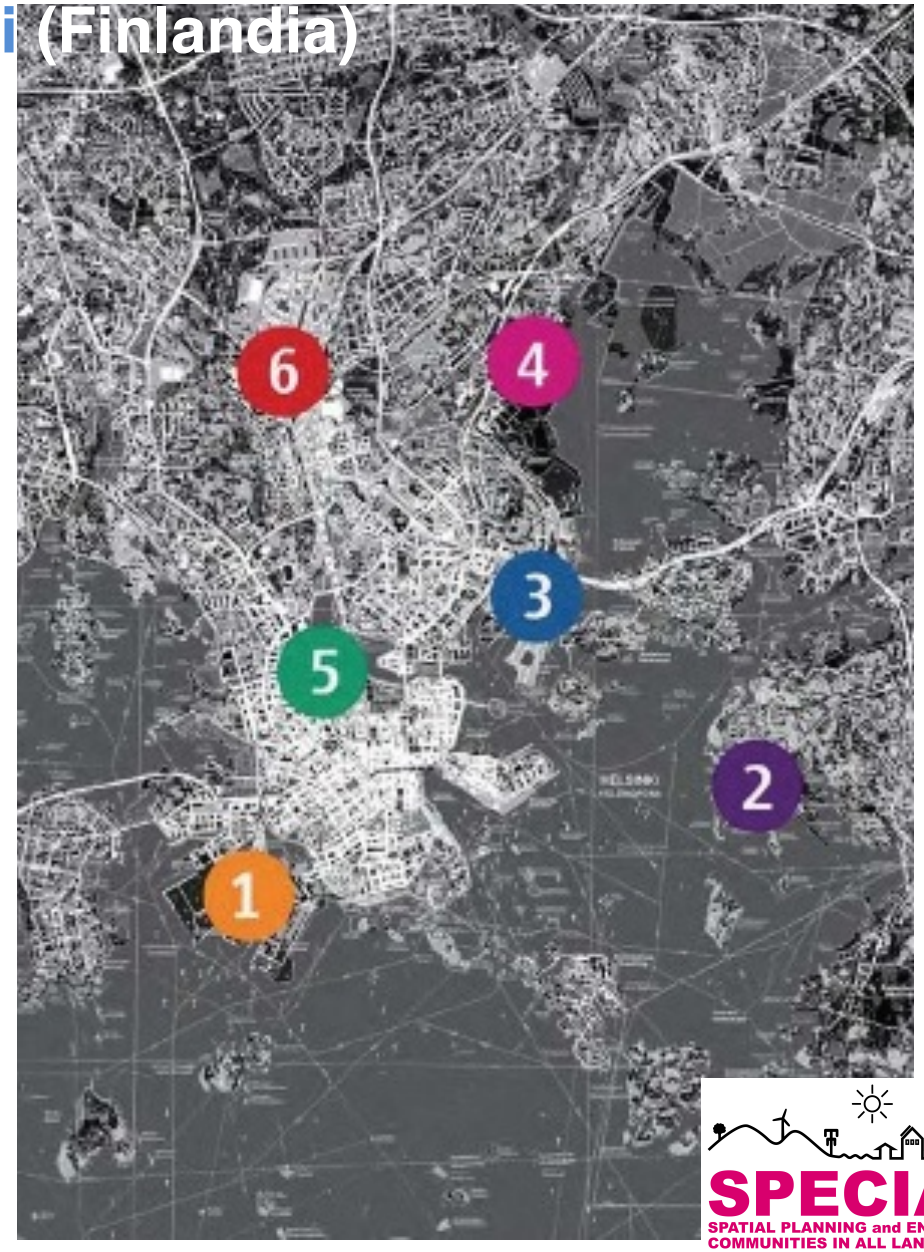
Kalasatama - Helsinki (Finlandia)

Il Piano di Helsinki individua 6 aree di intervento



1 JÄTKÄSAARI

2 KRUUNUVUORENRANTA

3 KALASATAMA

4 ARABIANRANTA

5 FINLANDIAPARK

6 PASILA

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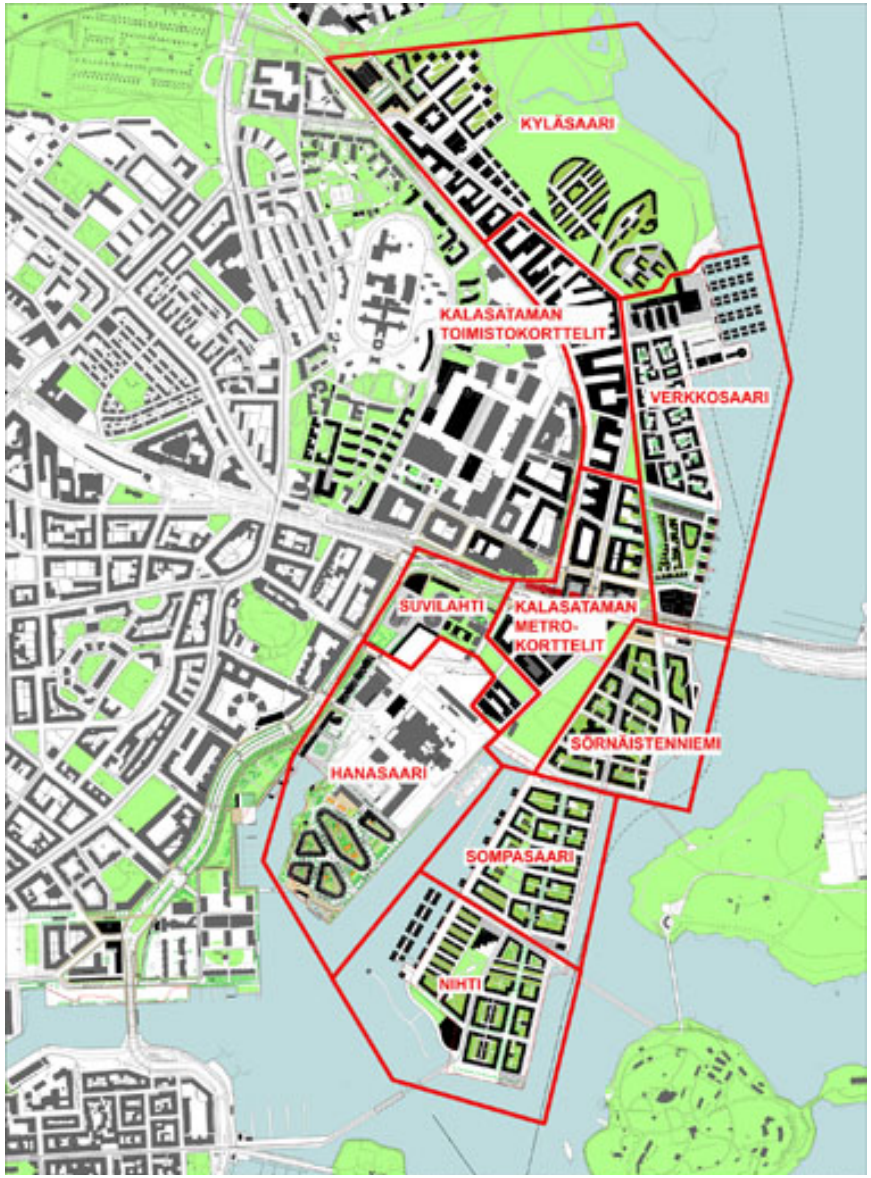
Kalasatama - Helsinki (Finlandia)



Il Piano per Kalatsatama prevede 9 sub-aree di intervento

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Kalasatama - Helsinki (Finlandia)

Natura intermittente delle energie rinnovabili

Non sono disponibili metodi pratici ed economici per garantire lo **stoccaggio** di ampi quantitativi di energia

Mancato utilizzo e/o spreco

Kalasatama - Helsinki (Finlandia)

Natura intermittente delle energie rinnovabili

Per ovviare a questo problema la **ABB**, in collaborazione con Helsingin Energia, utility pubblica della capitale finlandese, e con Nokia Siemens Networks, progetterà e installerà una "**smart grid**" su vasta scala a Kalasatama.

La ABB, Leader nelle tecnologie sostenibili, farà di KALASATAMA UN'AREA PILOTA per lo sviluppo delle smart grid.

Power and productivity for a better world™

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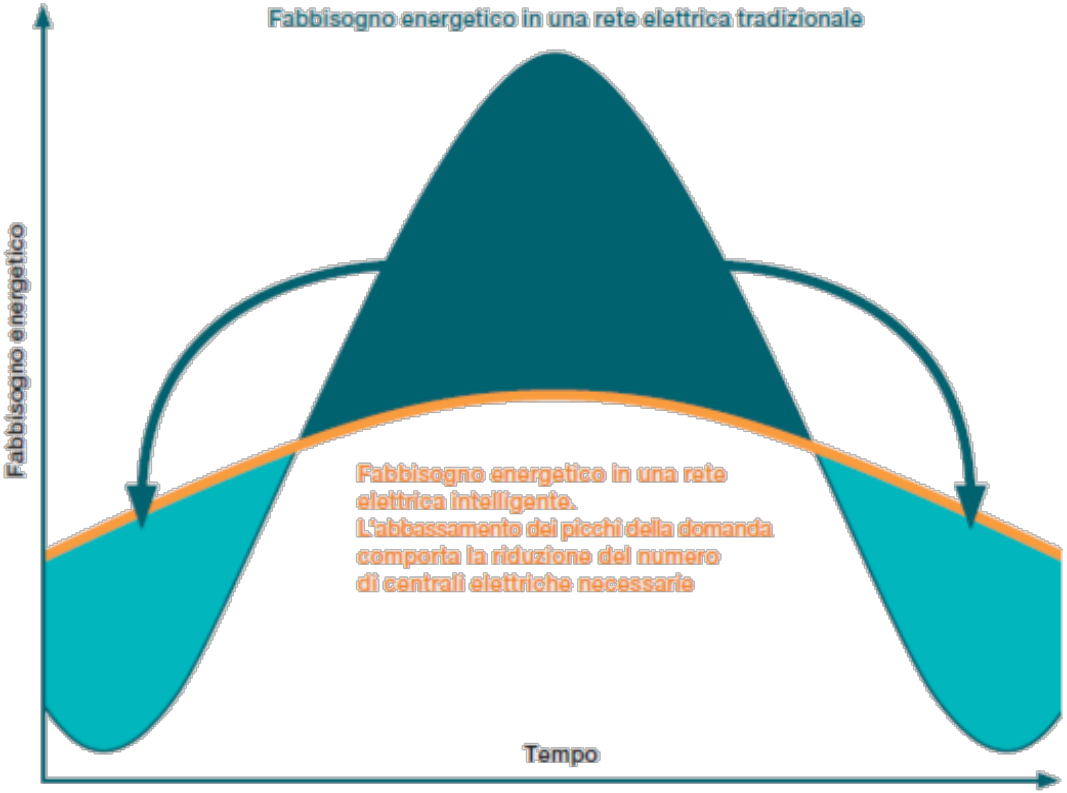
Nella **smart grid** con un sistema remoto e automatizzato di misurazione, controllo e invio dati si potrà controllare e gestire i consumi di energia, **bilanciando** i picchi e **ottimizzando** i consumi in base al costo dell'energia.



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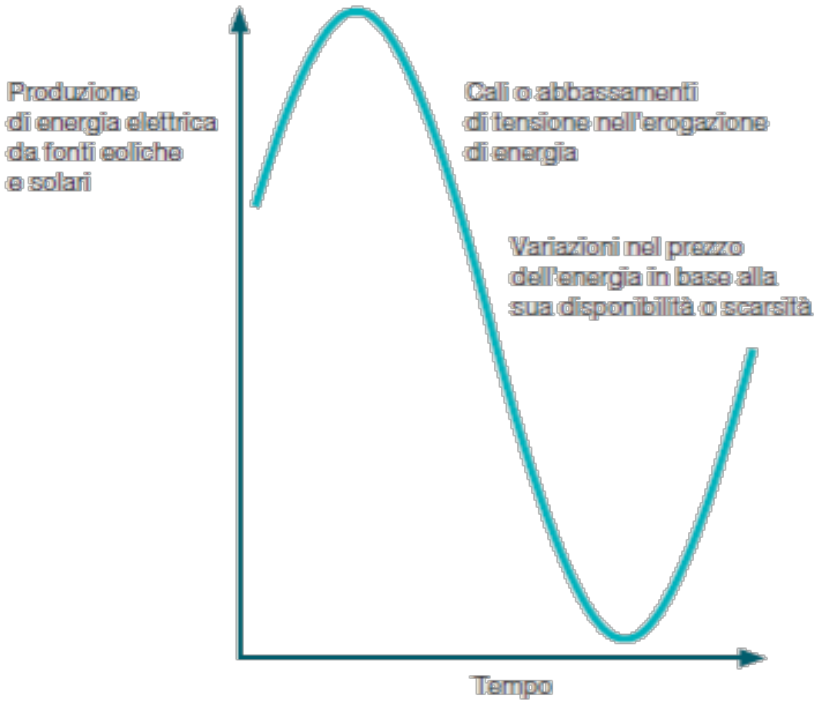
Sfide

Produzione di energia eolica e solare in eccesso in condizioni climatiche favorevoli



Soluzioni tecnologiche

- Disponibili
- In fase di sviluppo
- Emergenti

Le interconnessioni tra reti consentono l'esportazione dell'energia in eccesso o l'importazione da altre regioni durante i periodi di insufficienza della fornitura

Lo stoccaggio permette di sfruttare l'energia in eccesso durante i periodi di condizioni climatiche sfavorevoli

Le tecnologie di trasmissione fanno si che le fluttuazioni improvvise della domanda non si ripercuotano sulla qualità dell'energia

Le tecnologie informatiche permettono ai fornitori di gestire le fluttuazioni tramite la pianificazione della disponibilità e della domanda e l'adattamento automatico della capacità di generazione

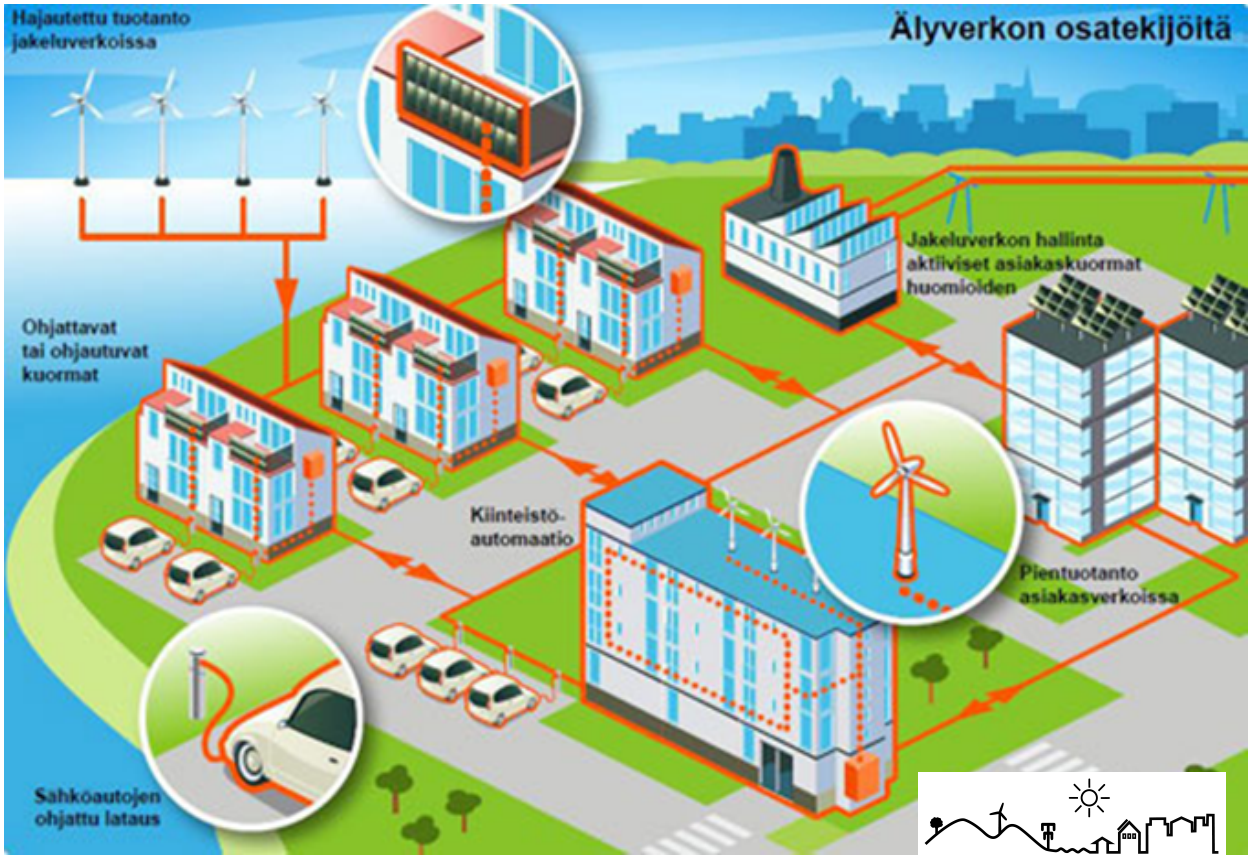
Le tecnologie "demand-response" permettono ai consumatori di regolare automaticamente il proprio consumo

Il crescente ricorso a fonti energetiche intermittenti introdurrà nuove variabili in termini di disponibilità e qualità dell'energia sulla rete. Molte delle tecnologie necessarie per superare le difficoltà legate all'utilizzo di energie rinnovabili su larga scala sono attualmente disponibili, mentre altre sono in fase di sviluppo.

Kalasatama - Helsinki (Finlandia)

Necessità di immagazzinare energia da fonti rinnovabili

Impiego dei **veicoli elettrici** per lo stoccaggio dell'energia in eccesso come fonte di riserva



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Kalasatama - Helsinki (Finlandia)

Necissità di immagazzinare energia da fonti rinnovabili

Impiego dei **veicoli elettrici** per lo stoccaggio dell'energia in eccesso come fonte di riserva

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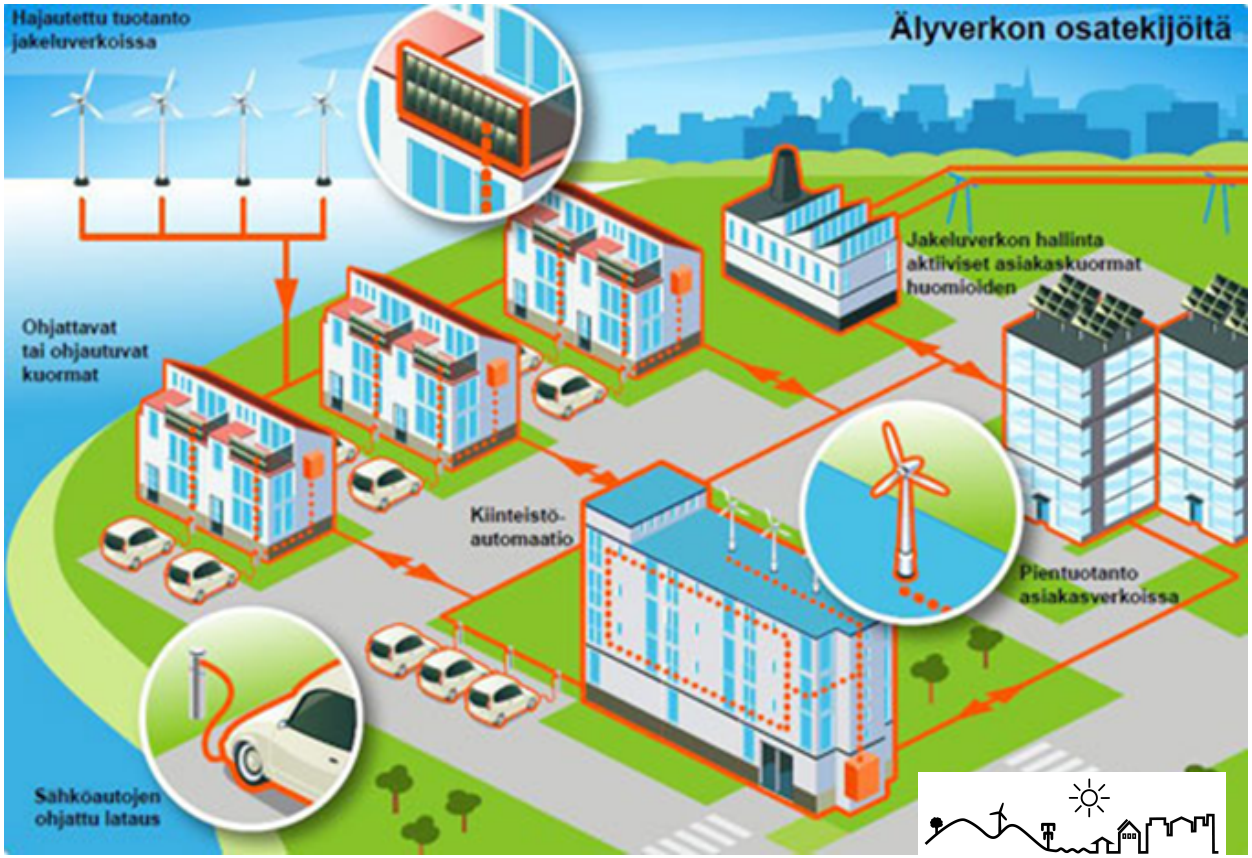
Kalasatama - Helsinki (Finlandia)

Partecipazione dei privati alla produzione di energia da fonti rinnovabili

Micro-eolico sulle coperture piane degli edifici

Pannelli solari nei balconi degli edifici



SPECIAL
SPATIAL PLANNING and ENERGY for COMMUNITIES IN ALL LANDSCAPES

Kalasatama - Helsinki (Finlandia)

Il Piano di sviluppo a lungo termine prevede l'utilizzo della fonte solare, delle biomasse e la realizzazione di due nuovi **impianti eolici offshore**, con una capacità produttiva di 500-1000 MW.

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Kalasatama - Helsinki (Finlandia)

Il progetto prevede un efficiente rete di **teleriscaldamento** e **teleraffreddamento** basato sul principio del riciclo l'energia. Il cascame termico prodotto dagli impianti di condizionamento si indirizza verso le zone che maggiormente necessitano di calore.

Il cascame termico prodotto dalle 'banche dati' potrebbe provvedere al riscaldamento di più di 9.000 nuovi appartamenti di 80 mq l'uno.

Le emissioni di CO2 dovute al teleraffreddamento rappresentano solo una **piccola frazione** delle emissioni che si avrebbero con impianti di climatizzazione privati.

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Kalasatama - Helsinki (Finlandia)

Sistema di differenziazione e raccolta dei rifiuti (ENVAC)

Nuovi Iconemi urbani

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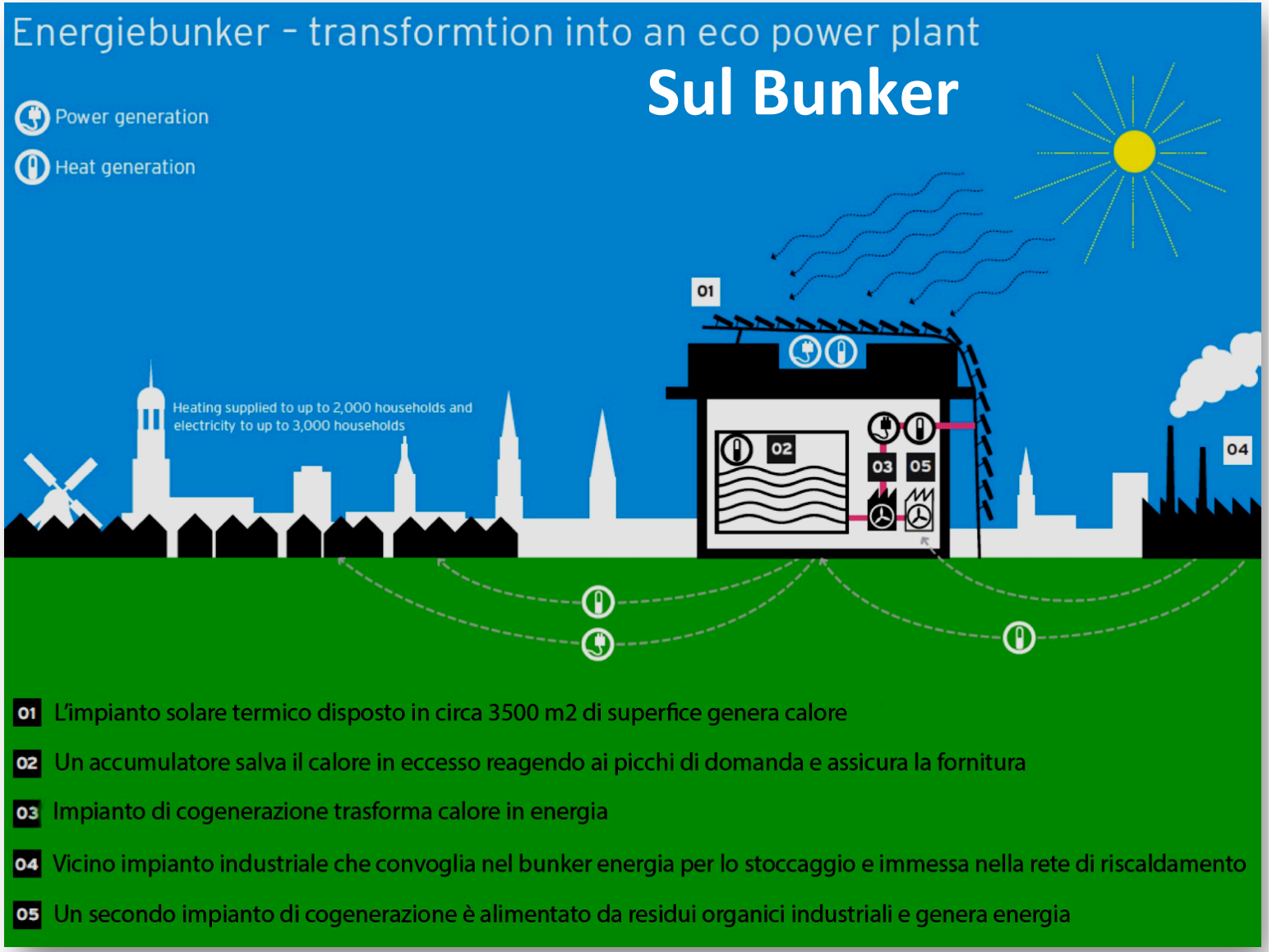
Wilhelmsburg – Hamburg (Germania)

The Energy Bunker

- Uso di fonti di energia rinnovabile a scala locale
- Produzione combinata di elettricità e calore attraverso bio-metano
- Fornitura di calore per 3.000 abitazioni ed elettricità per 1.000 abitazioni
- Riduzione di emissioni di CO_2 del 95%

Wilhelmsburg – Hamburg (Germania)

- Pannelli fotovoltaici: 1100 m² su tetto
- Pannelli solari in facciata: 1600 m² su lato sud



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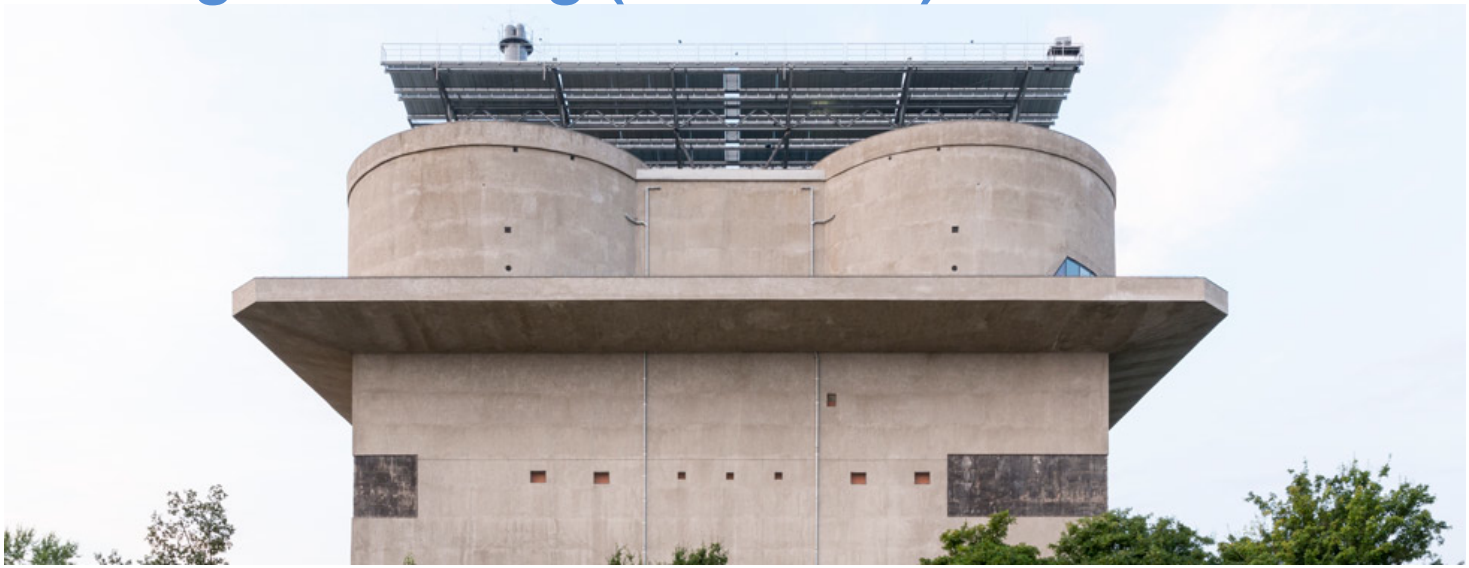
Wilhelmsburg – Hamburg (Germania)



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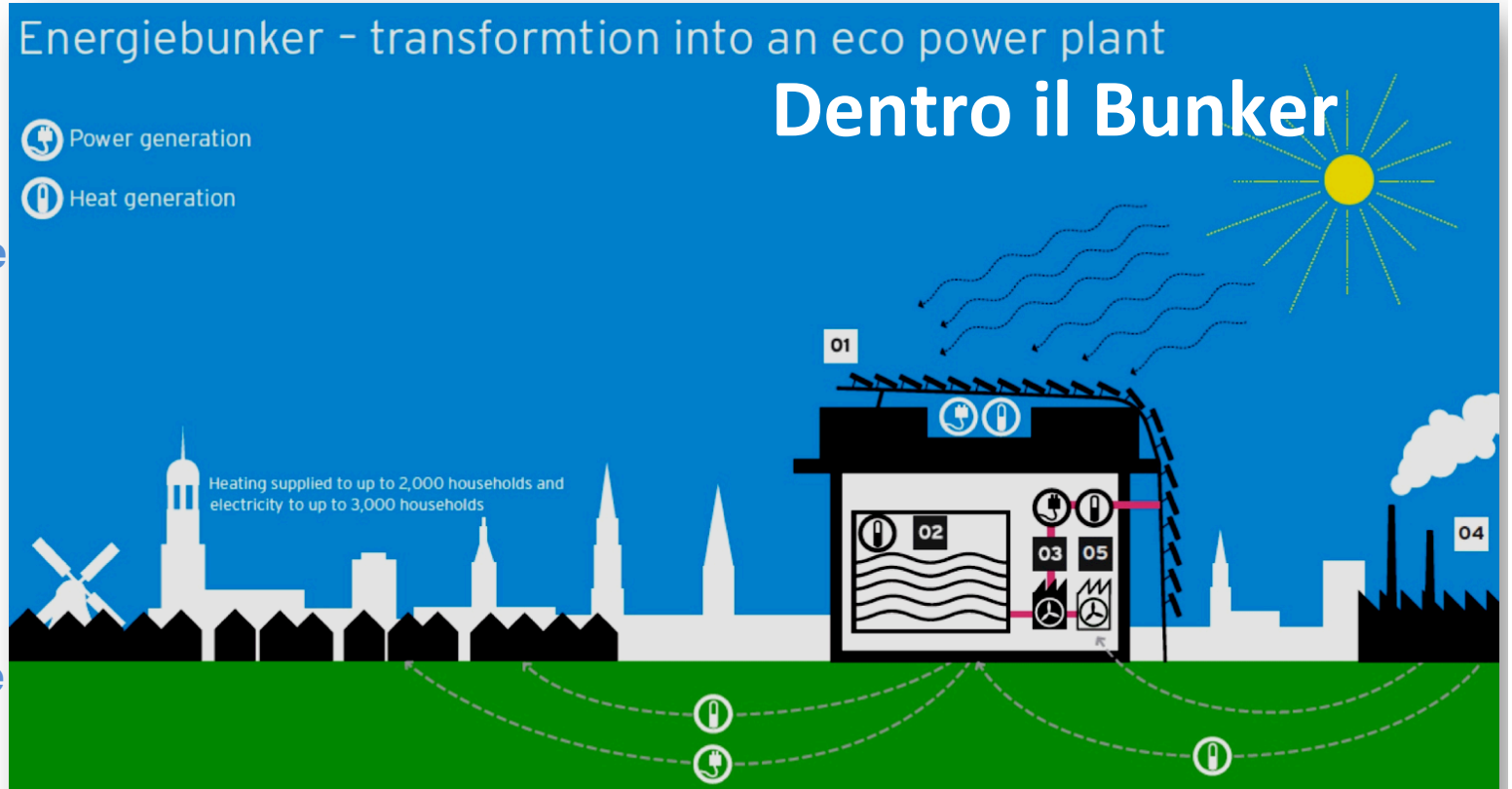
Wilhelmsburg – Hamburg (Germania)

- Impianti di cogenerazione che utilizzano biogas/scarti del legno e cascami termici industriali
- Accumulo e conservazione di energia termica (serbatoi per 2000 mc)



01 L'impianto solare termico disposto in circa 3500 m2 di superfice genera calore

02 Un accumulatore salva il calore in eccesso reagendo ai picchi di domanda e assicura la fornitura

03 Impianto di cogenerazione trasforma calore in energia

04 Vicino impianto industriale che convoglia nel bunker energia per lo stoccaggio e immessa nella rete di riscaldamento

05 Un secondo impianto di cogenerazione è alimentato da residui organici industriali e genera energia

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Wilhelmsburg – Hamburg (Germania)

Overview of the Energy Supply

Efficient and large-scale use of renewable local energy

Simultaneous generation of electricity and heat through combined heat and power, based on Biomethane

Storage of (heat) energy, to compensate for the non-controllable solar energy and to increase power generation in the combined heat and power unit, in a large reservoir, with a capacity of approximately 2000 cubic metres, within the bunker

Use of solar energy in a large-scale unit covering around 2,000 square metres
wood chip boiler = 2000 kWth / 10,5 GWhth/a
Biogas CHP = 500 kWth and 400 kWel / 3,750 GWhth/a and 3 GWhel/a
Low Temperature Oil Peak Load Boiler: 2300 kWth / 3,570 GWhth/a
Solarthermal = 1050 kWth / 0,6 GWhth/a
Photovoltaic (1100 m²) = 0,11 GWhel/a
Waste heat = 500 kWth / 4 GWhth/a
in total = 22,42 GWhth/a and 3,1 GWhel/a

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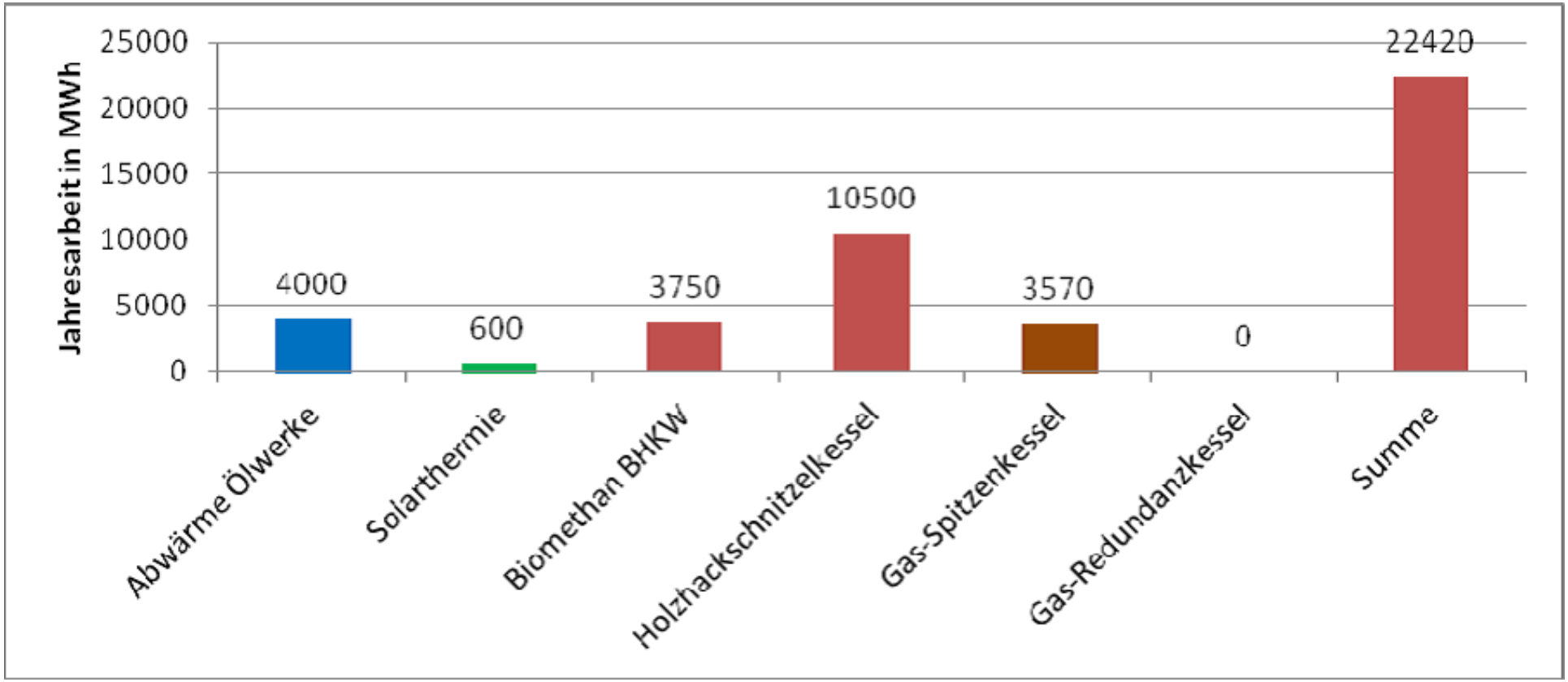

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Wilhelmsburg – Hamburg (Germania)

The Energy Bunker

- Superficie lorda: 57x57 m
  Altezza: 42 m
- Centro documentazione (880 m²) e caffetteria (540 m²)

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The Bunker – Vienna

Da rifugio anti-aereo ad Acquario e museo del Mare

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Energy Hill

Da discarica di rifiuti tossici a modello esemplare di generazione di energia da fonti rinnovabili

- Fornisce energia elettrica a 4.000 abitazioni trasformando energia eolica e solare
- Rappresenta uno degli spazi verdi fruibili più estesi e stimolanti della città (40 metri di altezza su 45 Ha di cui 22 accessibili al pubblico)

Energy Hill

1. La storia

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Prato naturale, cava di estrazione argilla, discarica di inerti, discarica di rifiuti urbani, tossici, ingombranti

Energy Hill

2. Messa in sicurezza

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Sistema di impermeabilizzazione con geomenbrana plastica di spessore 1,5-2 mm fino ad uno spessore totale di 3m per evitare le infiltrazioni di acqua piovana

Energy Hill

3. Trattamento dell’acqua

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Depurazione dell’acqua di ruscellamento per evitare eventuali infiltrazioni (impianto all’interno dell’info point)

Energy Hill

4. Monitoraggio

Dispositivi di monitoraggio delle acque di ruscellamento, dei pressione del gas metano interno alla collina

6 aree campione (10x50 m) per monitorare il funzionamento dello strato di impermeabilizzazione

Energy Hill

5. Riuso del gas metano

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Estrazione di gas metano, prodotto della decomposizione di rifiuti organici e, attraverso una stazione di compressione, inviato nella contigua area industriale

Energy Hill

6. Energia geotermica

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Per raffrescare info point

Energy Hill

7. Biodiversità

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Prati e arbusti garantiscono la stabilità del sistema di copertura. Gli alberi necessitano di essere potati/tagliati periodicamente per evitare danni alla geomembrana.

Energy Hill

8. Pale eoliche

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La prima installata nel 1992. Altre tre più piccole nel 2004. Con diametro di 104 m, intercettano il vento in un'area di 8.500 mq.

Energy Hill

9. Pannelli fotovoltaici

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4.000 pannelli fotovoltaici, con 1.600 ore di sole/anno, forniscono energia elettrica a 200 unità abitative

Energy Hill

10. Accessibilità e fruizione

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Energy Hill

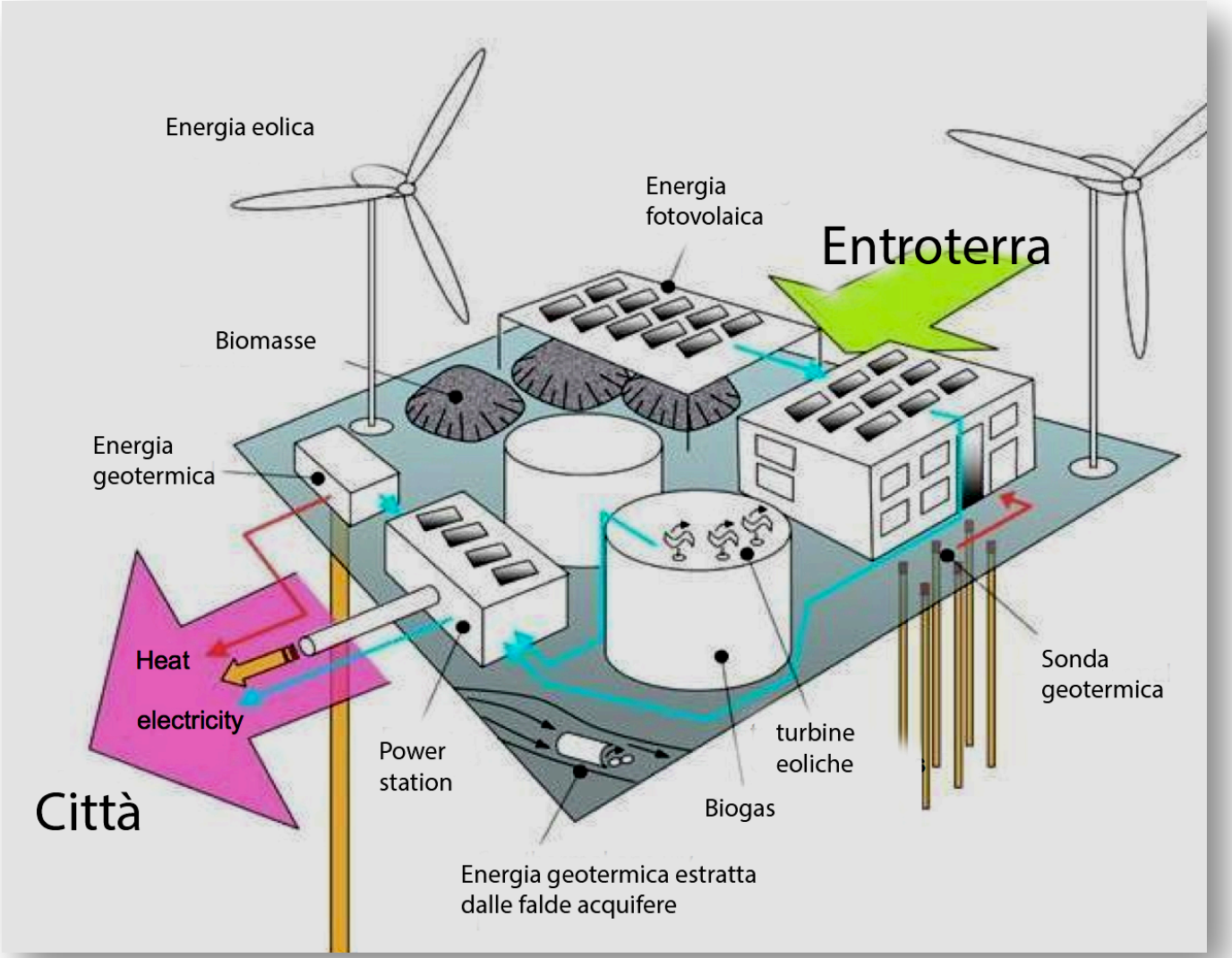
- Impianto Fotovoltaico 700 kWp
- Pale eoliche 3.400 kWp
- Biogas da Biomasse (da sfalci dei prati)
- Impermeab. Per evitare infiltrazioni di acque piovane
- Elettricità a 4.000 abitazioni
- (12.200.000 kWh/a)

Energy Hill

- Energia geotermica da acque sotterranee per condizio-namento InfoPoint;
- Gas metano da processi di decom-posizione interni

Energy Hill

Utilizzo di energia da fonti rinnovabili LOCALI



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Energy Hill

Horizon path- il percorso sospeso

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Termovalorizzatore – Vienna

Waermeturm (Hundertwasser, 1987)

Teleriscaldamento e teleraffreddamento

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Termovalorizzatore – Vienna

Waermeturm (Hundertwasser, 1987)

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