Treating Waste as a Resource

Inspiration from Sweden

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If our focus is disposal

our plants become wasteful

Community

Plant

Water
Organic energy
Minerals

Electricity
Chemicals

CO_2

Effluent

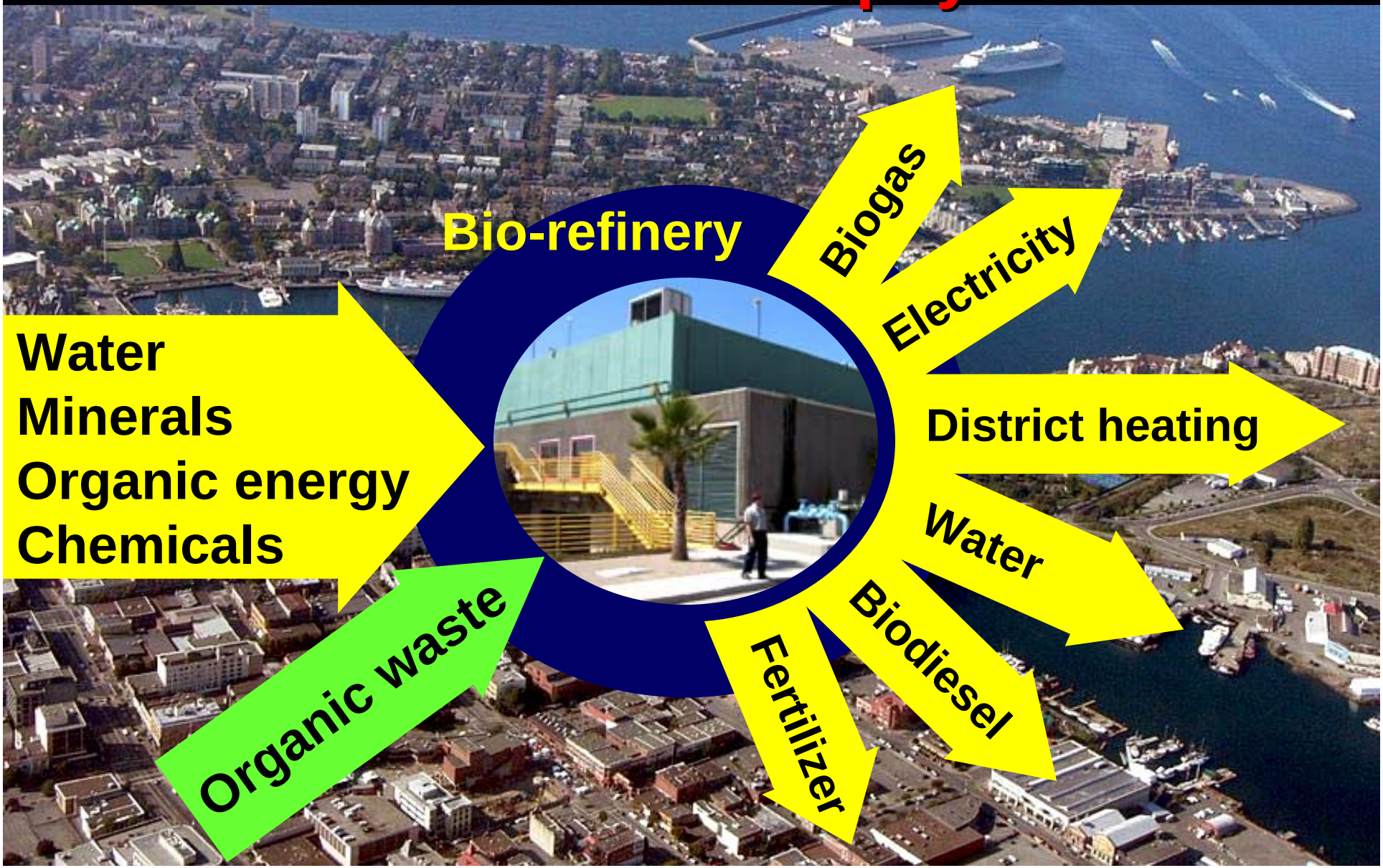
Sludge

"Raw materials"

"Products"

If our focus is the community

we'll make waste pay



Clean home, dirty community

once-through model

Food

Water

Energy

Heavy eco-footprint

Greenhouse Gas

Solids

Liquids

landfill

treatment

Upstream Impacts

Downstream Impacts

Clean home, healthy community

eco-cycle model

Food

Water

Energy

GHG

Solids

Liquids

resource recovery plants

Light eco-footprint

Biofuels

Power

Minerals

Water

Heat

Why bio is better

CO_2

Broken cycle

Fossil fuels

Closed cycle

CO_2

Biofuels

More sustainable

Resources from waste

Biodiesel

Fuel

or

Electricity

Oil & grease

Biogas

District heating
& cooling

Sewage

Garbage

Treatment

Heat
pump

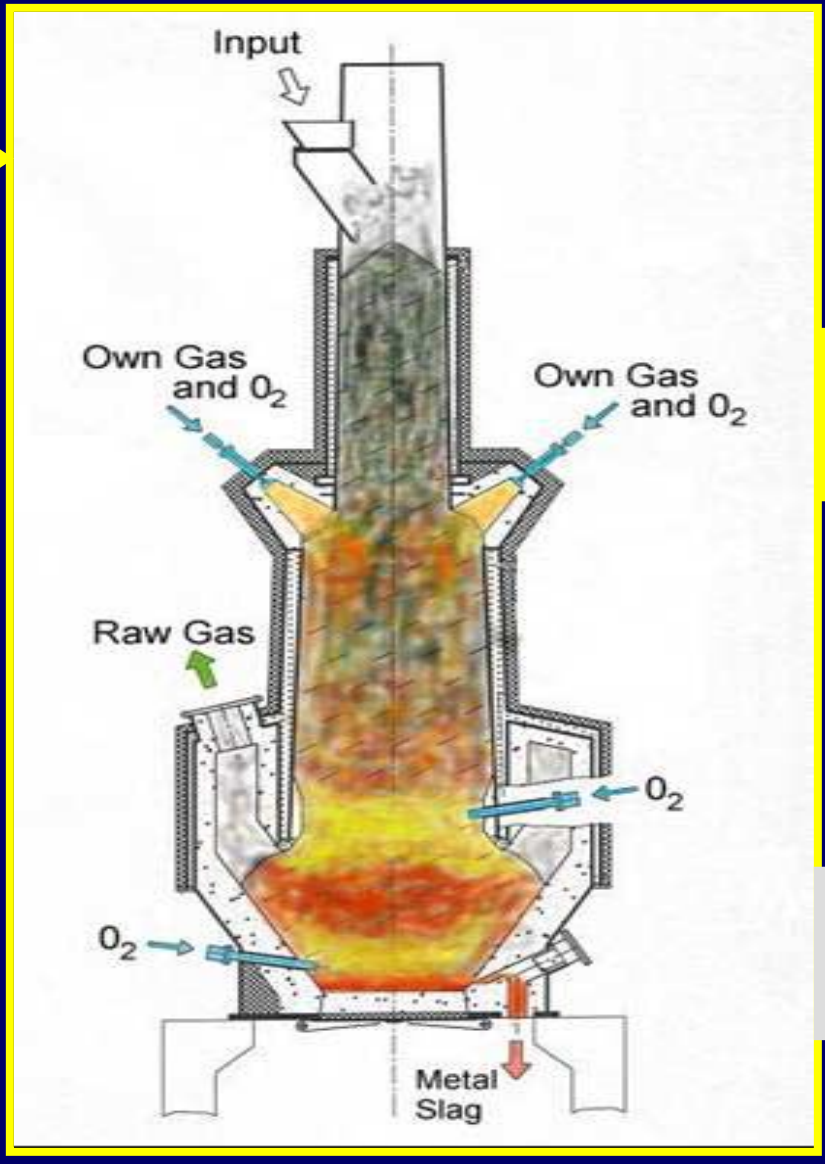
Disinfection

Water for
industry,
irrigation

What about the sludge?

another source of energy

Sludge

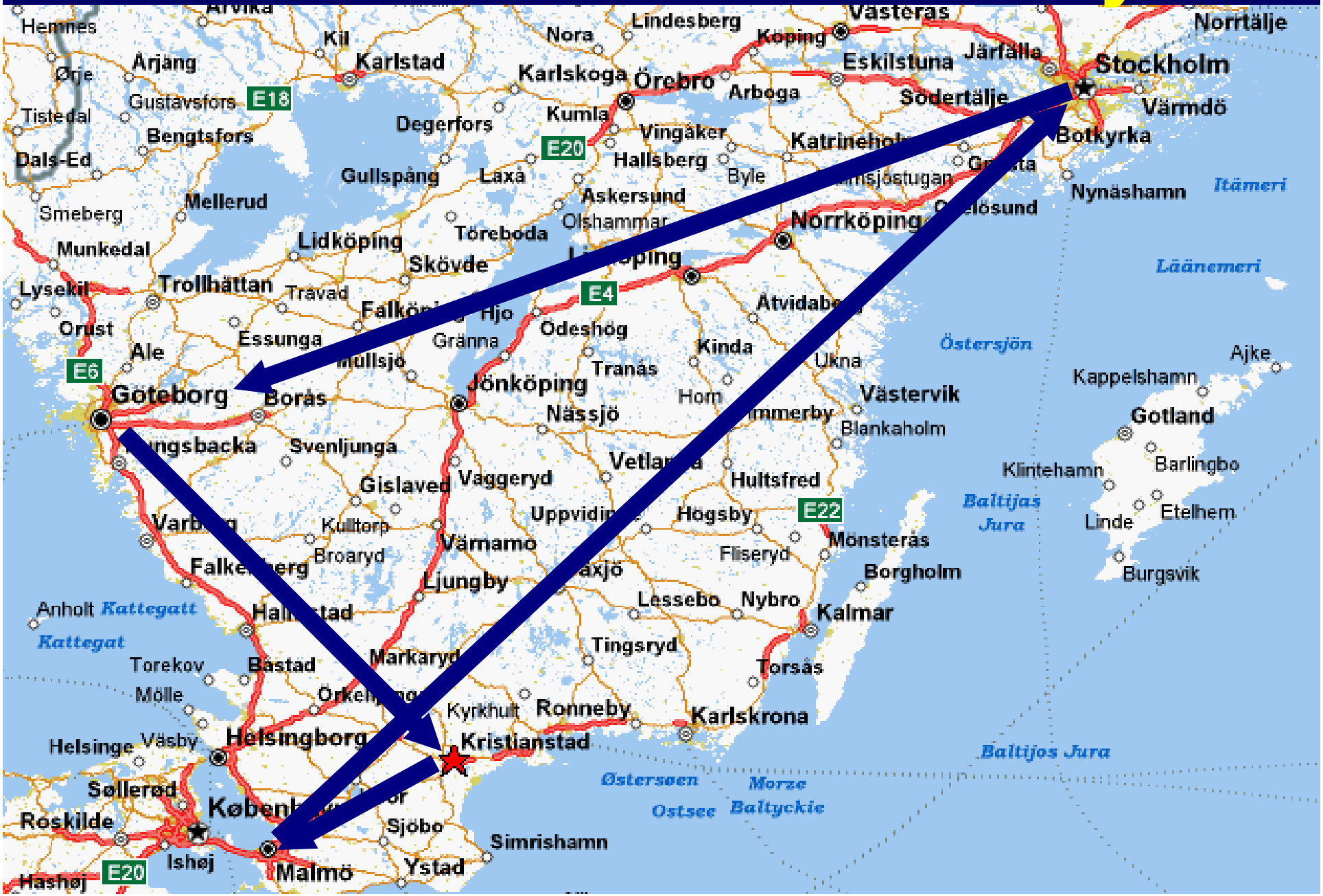


Gas

Ash

The residue of biogas production in a treatment plant (sludge) can be gasified, where 2,700ºC temperatures break <u>all</u> organic material into synthetic gas. The remnant ash contains metals, and can be stored or refined. Metal contaminants are thus concentrated rather than dispersed.

Southern Sweden in 8 Days



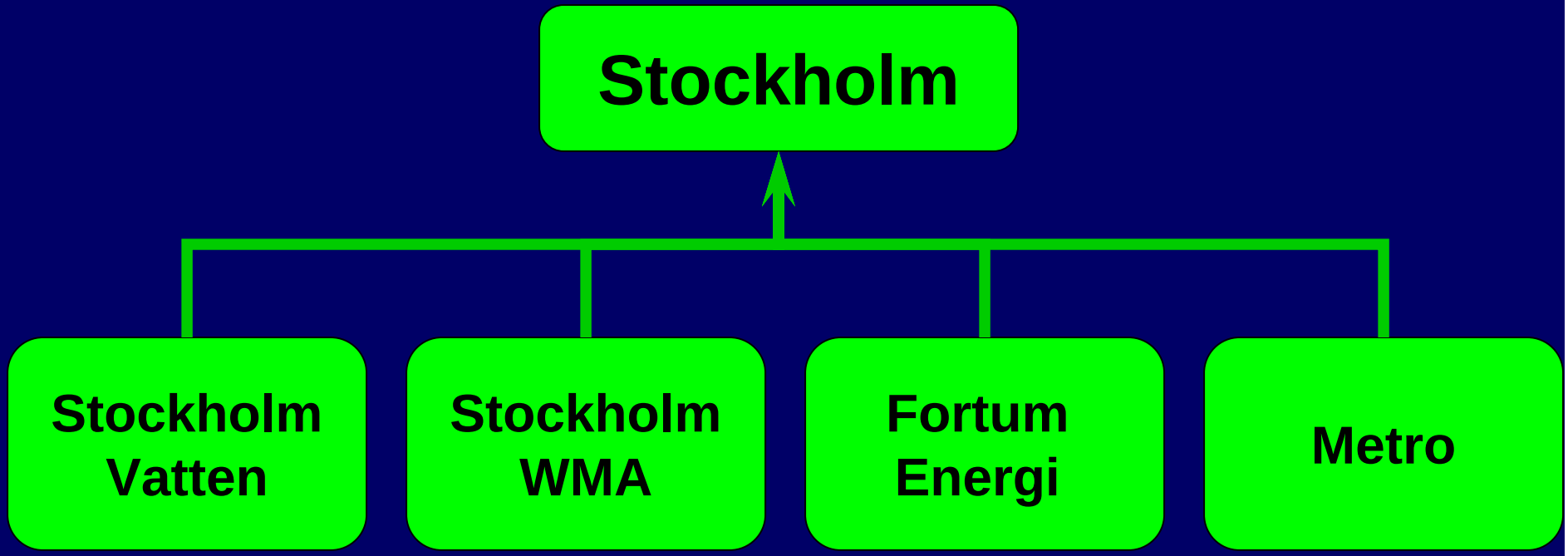
Inspiration from Stockholm

"Waste and refuse are resources in the wrong place."

City of Stockholm

Integrated community planning

Swedish for common sense



Each Swedish city owns separate companies for managing sewage, solid waste, energy, and transportation. These companies take their direction from the municipal council, and integrated planning ensures the best results for the community as a whole.

Stockholm's Henriksdals tertiary treatment plant is buried in the hill, and a large apartment block is located directly above the plant.

The front of the Henriksdals treatment plant looks like an office building.

Raw biogas is about 70% methane and 30% CO_2. The Henriksdals plant upgrades this raw gas to 98% methane for sale to Stockholm's bus company, and as cooking fuel to the Hammarby Sjöstad development.

Biogas runs 30 buses in Stockholm so far, and will increase the number to 200 by 2010, by producing more biogas from organic waste in the Henriksdals plant. Each biogas bus added in the inner city displaces an ethanol-powered bus to the suburbs, where a diesel-powered bus retires.

Stockholm's energy company (Fortum Energi) uses heat pumps to extract heat from treated sewage effluent to provide hot water and heating to 80,000 apartments, including the Hammarby Sjöstad development. After the heat has been extracted, effluent is just above freezing. This "coolth" is directed through a separate network of district cooling pipes for refrigeration and air conditioning. The sewage plant is paid for this energy as well as for their biogas, which helps offset the cost of treatment.

Kitchen waste in Hammarby Sjöstad is collected via underground vacuum tubes, and increasingly is sent to the sewage treatment plant to produce biogas; an ecologically closed loop.

Leadership from Gothenburg

Gothenburg's biogas digesters...

...accept kitchen waste & grease as well as sludge.

Biogas produces power and heat for the plant, and the remainder of biogas is sold to the city.

Gothenburg's energy company (Göteborg Energi) also uses heat pumps to extract heat from treated effluent, to provide hot water and heat to 36,000 apartments through their district heating pipes. Energy companies pay to insulate their clients' buildings, which allows more clients to be added to the district heating network. In this arrangement the interests of the energy company and the environment are completely aligned.

Integration in Kristianstad

Kristianstad is in the heart of an agricultural community in the Skåne region of Sweden. In the 1990s the municipality moved to address several problems at once; disposal of organic waste, air pollution from transportation, and the need to mitigate climate change. Kristianstad is the lowest point in Sweden, at several metres below sea level; residents are well aware of the threats presented by climate change.

Kristianstad collects kitchen waste separately; organic waste was banned from Swedish landfills in 2005.

The Karpalund biogas plant accepts kitchen waste, agricultural waste, and waste from local food factories. Since the raw material is clean, residue from digestion does not contain the contaminants found in sewage sludge, and so is returned to farm land.

Biogas is also produced from Kristiansad's sewage plant. Residue from this plant is not applied to farmland, but is applied to industrial sites such as mines and gravel quarries.

Kristianstad produces far more biogas than can currently be used in buses and cars. The excess is burned in the city's Allöverket cogeneration plant along with wood waste. The plant produces electricity and heat for the city's district heating system.

Most downtown apartments and offices are heated through the city's district heating system, including the charming city hall, pictured here.

Biogas also runs all transit buses, a number of trucks...

...plus ten taxis...

...plus 220 cars, ramping up to 1,500 in the future.

Välkommen
E.ON Förs.Sverige AB

KVITTO FÖR TANKNING

DATUM OCH TID	2006-10-06 12.00
PUMP	1, BIOGAS
VOLYM	15,84 M3
PRIS	9,13 KR/M3
TOTALT BELOPP	144,61 KR
VARAV MOMS	28,93 KR

KORTBETALNING

Transaktionstyp:	Köp
(Personlig kod)	
Kortnr:	
Belastat:	Konto
Belopp:	SEK 144,61
Kontrollnr:	636046
Refnr:	713
Terminal:	563

Biogas in Kristianstad is about 25% cheaper than gasoline, due in part to the Swedish carbon tax on fossil fuels, and to the fact that biogas is produced from waste. The city subsidizes the cost of converting a car to biogas, and provides owners of biogas cars with free parking.

Cutting through the cost barrier

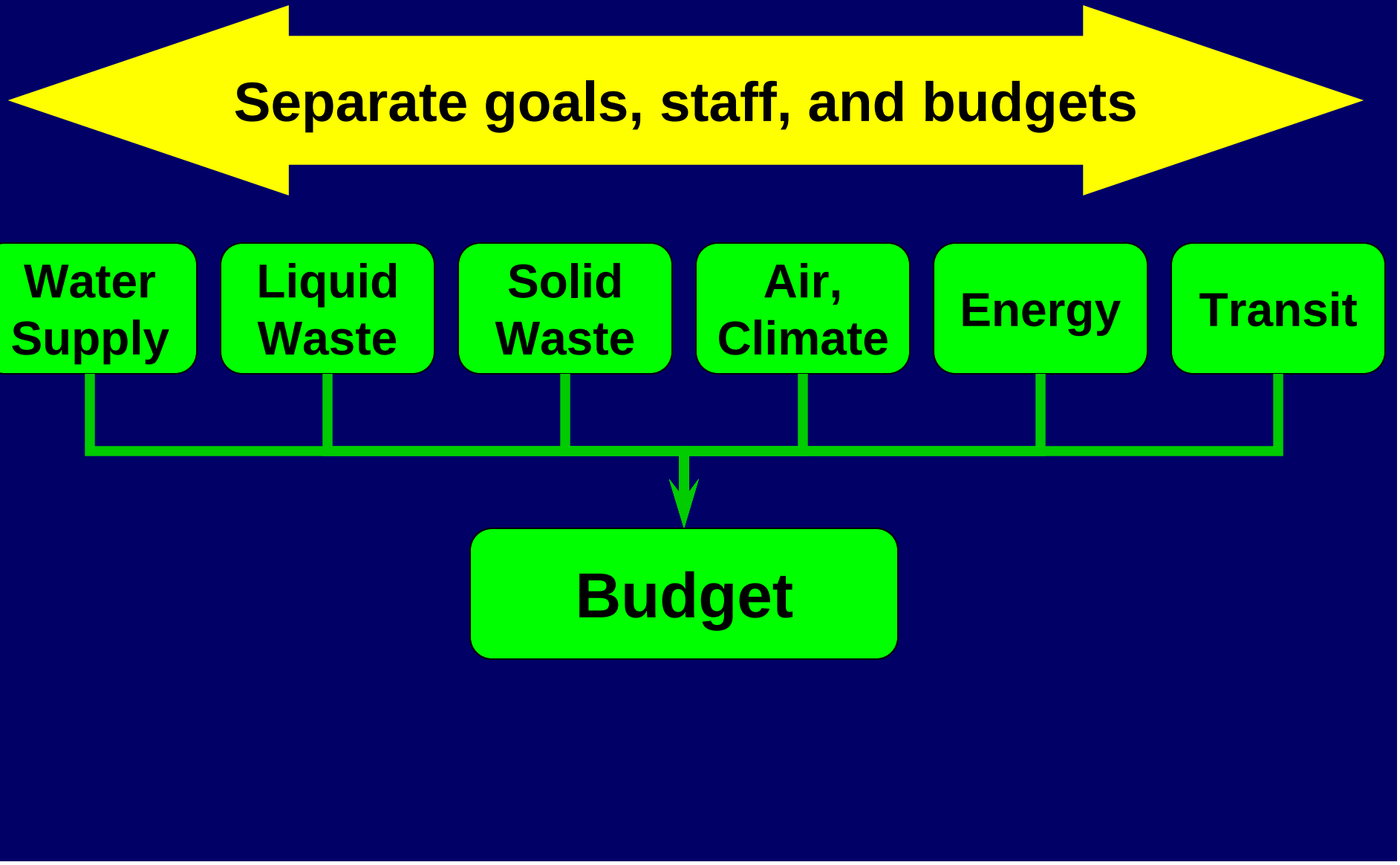
the cost of living sustainably

Cost of Treatment (per home per year)	City
$120.00	Canadian average
$86.11	Gothenburg
$77.84	Stockholm

Sewage treatment costs are offset by revenues from the sale of biogas and heat. Since Swedish plants are net energy providers, the cost of treatment will fall as energy prices rise over time. Typical Canadian treatment costs rise with energy prices.

In the administrative world,

the issues are separate



In the physical world,
solutions are connected

Common problems, impacts, and solutions

- Water Supply
- Liquid Waste
- Solid Waste
- Air, Climate
- Energy
- Transit

→ **Eco-footprint**

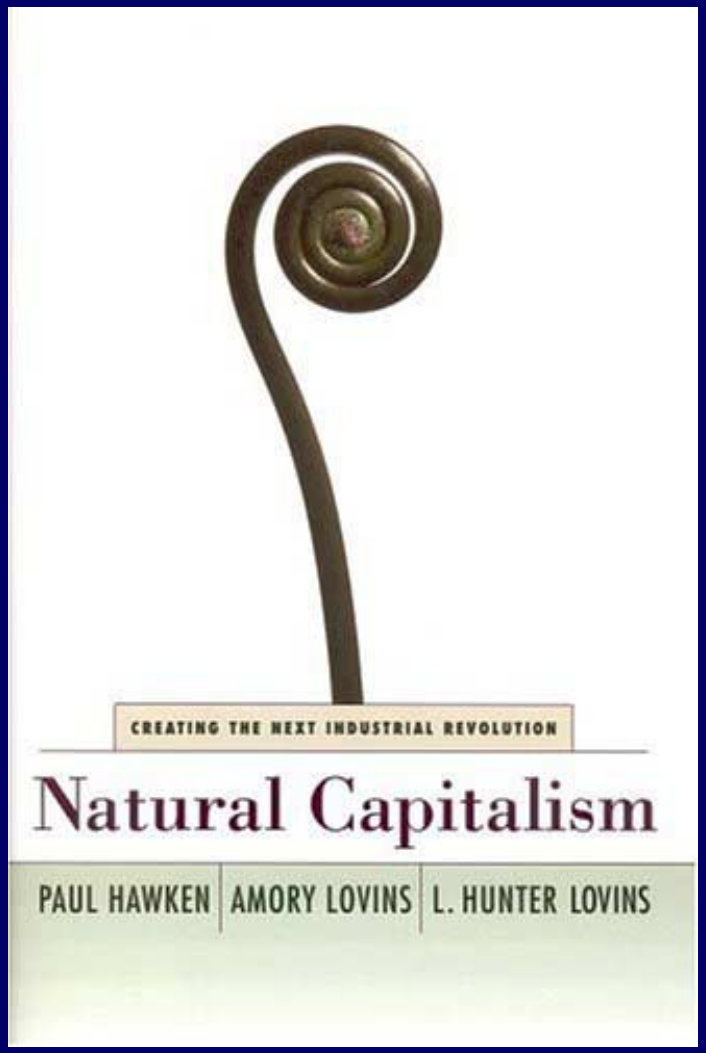
When we try to pick out anything by itself, we find it attached to everything else in the universe.

John Muir, 1892

Ecology at work

Radical resource productivity

"Optimizing the components in isolation tends to pessimize the whole system"



"Nature does not compromise, nature optimizes"

Suggestions from Sweden

what would you do in our place?

- **Integrate the planning**
- **Protect water, land, *and* air**
- **Recovering more costs less**

We are the architects
of our communities

As individuals, we can:

- **Reassure our leaders, we are not afraid**
- **Engage in public consultations**
- **Ask *what if, why not?***



Would you like more info?

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