

Eco-cycle-based waste management system in Oslo



Green goals for Oslo

- **“We will hand over the city in a better environmental condition than we inherited it”**
Oslo’s sustainability vision
- 50 % material recycling within 2018
- 50 % reduction in CO₂-emissions within 2020
- 95% reduction in CO₂-emissions within 2030
- 60% reduction in NO_x-emissions within 2022



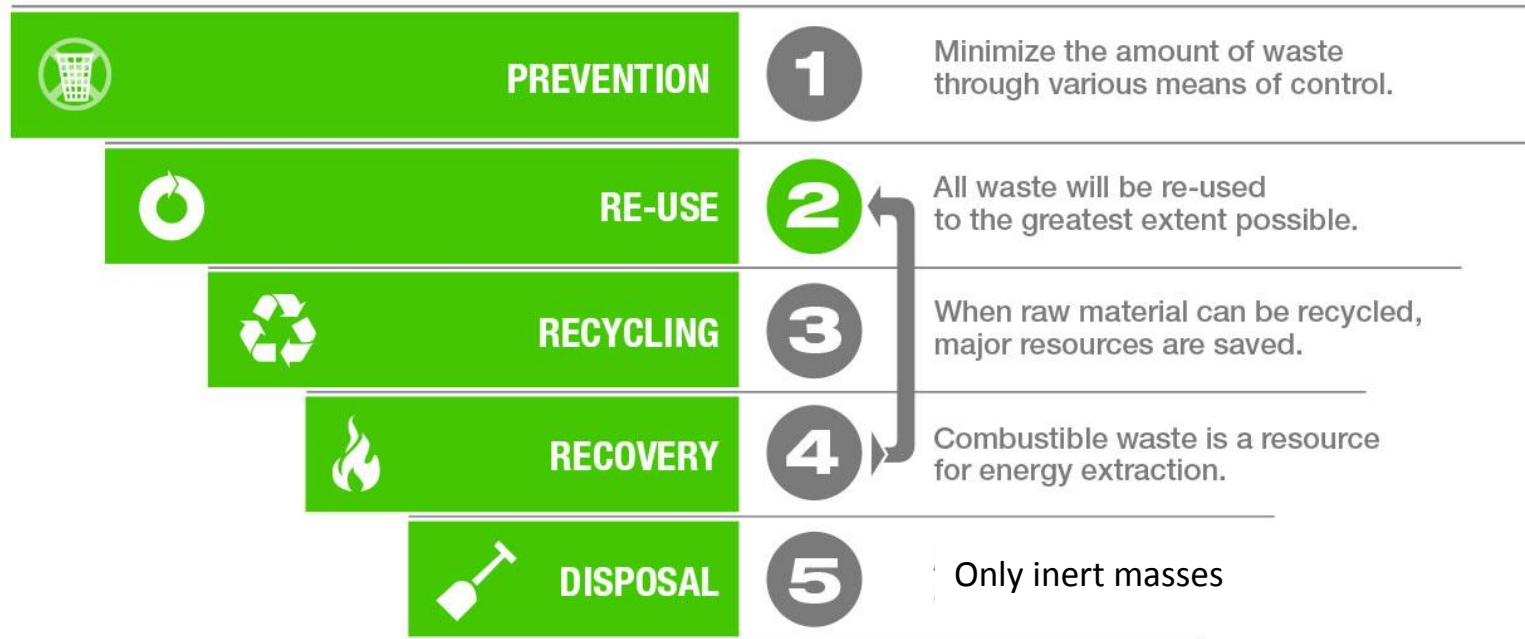
**OSLO! GO
GREEN**

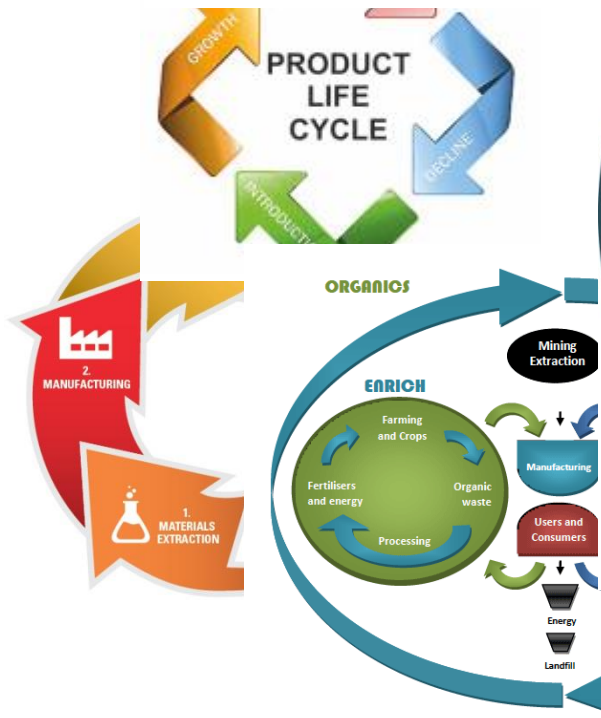
Waste management in Oslo

- 1897: Agency for Waste Management established
- 1932: The municipality become responsible for the collection of all household waste
- 1967: First Waste-to-Energy Plant
- 1986: Second Waste-to-Energy Plant
- 1990: Source separation of glass packaging, paper and hazardous waste starts, first recycling station established
- 2007: Closing of last landfill in Oslo
- 2009: Landfill ban of burnable waste in Norway
- 2009: Starting source sorting of food waste and plastic packaging, optical sorting plant
- 2012: Biological treatment plant producing biogas and biofertilizer
- 2016: Test of carbon capture from Waste-to-Energy

Living by the waste hierarchy

EU'S WASTE HIERARCHY





2 billion tons of household
waste — every year



Foto: Dimitar
Dilkoff/AFP

EU - goals 2030

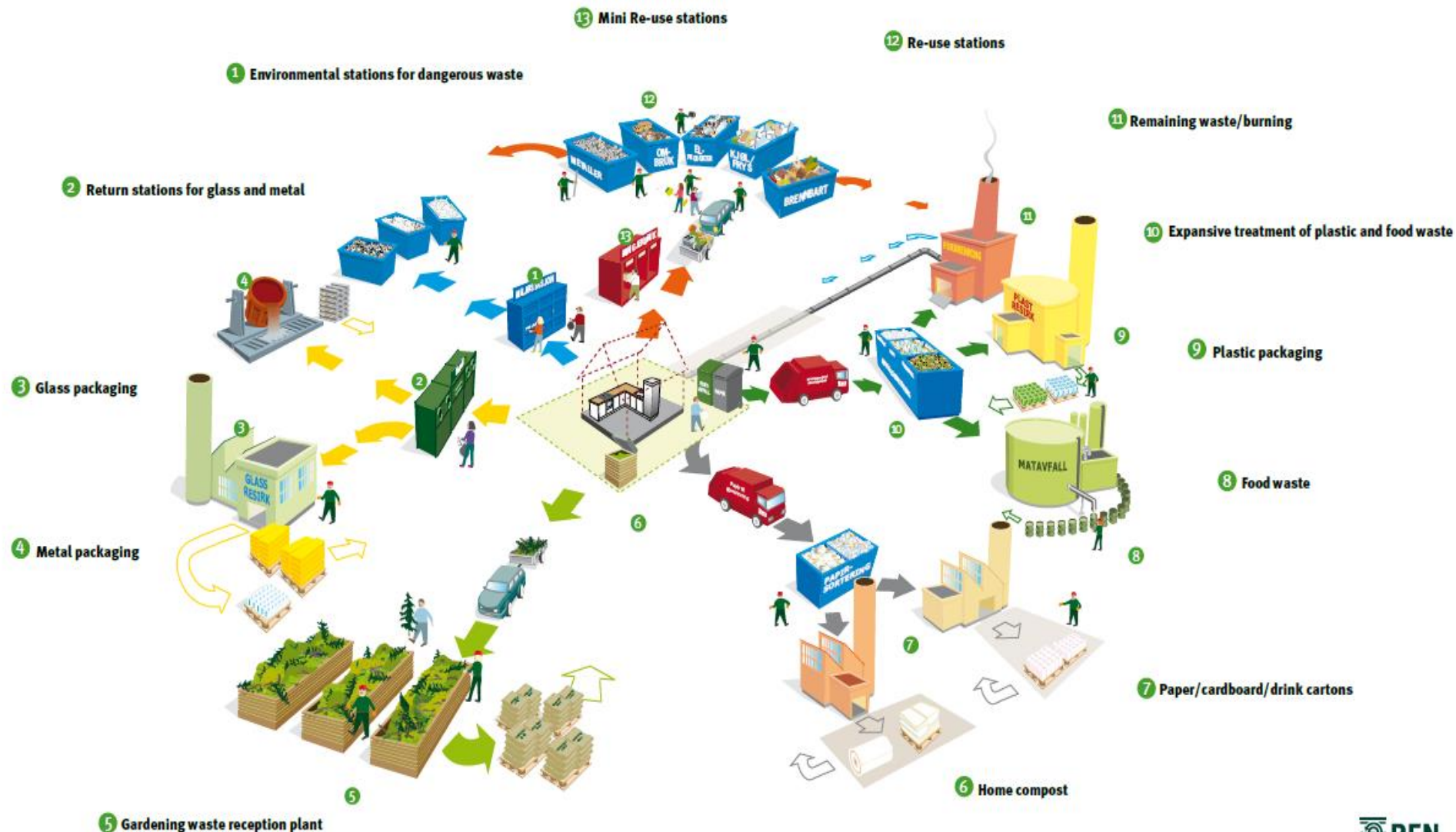




Read more about treating waste in Oslo at www.ren.oslo.kommune.no

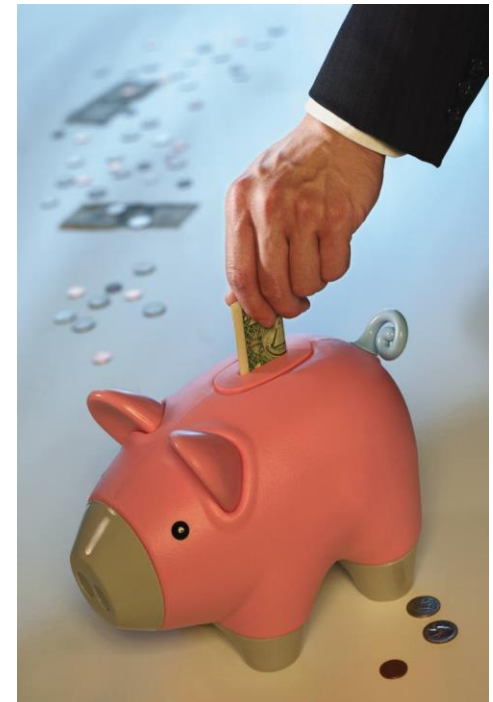


How do we treat waste in Oslo?



Finance system

- Mandatory fee – based on produced waste
- We are a self-financing organization
- What does it cost?
 - Annual budget 2015: 750 mill. NOK, 80 mill. €
 - Cost per citizens 2015: 991 NOK, 104 €
- Included: All costs related to the services provided
 - Collection of residual waste and paper at the household
 - Use of recycling stations, local recycling stations, local collection sites, hazardous waste stations.



Circular system of waste management; circular economy in practice





Plastic
packaging

Residual
waste

Food
waste



Optical sorting

Worlds largest of its kind, runs without human touching of waste.

High regularity, high quality, >95% of all coloured bags sorted, and purity of fractions > 97%

Source separation

To day pr citizen:

- 6 kg/year plastic packaging
- 33 kg/year foodwaste

Possible goal:

- 10 kg/year plastic packaging
- 50 kg/year foodwaste.

- 9 /10 say they source separate
- Good intention, but a wish is not the same as action, so allow 10 years for the city to adopt best sorting practice!



Romerike biological treatment plant

- Finished december 2012, technology by Cambi (Norway)
- Capacity: 50 000 t/year, Thermic hydrolysis (THP)
- Only food waste, 6 mill Nm³ CH₄ year (99%, liquid and compressed), Biofertilizer of all foodwaste



Biogas-fueled buses



Organic fertilizer for farming



Waste-to-Energy

Two plants, located in the north and south perimeter of the city

- A total of 5 lines, different technical suppliers
- Capacity: 450 000 t./year, 52 t./hour, approx 175 MW
- First operation 1967, continuously investments and capacity increases since then
- Electricity: 175 GWh/year
- Heat production: 1000 GWh/year

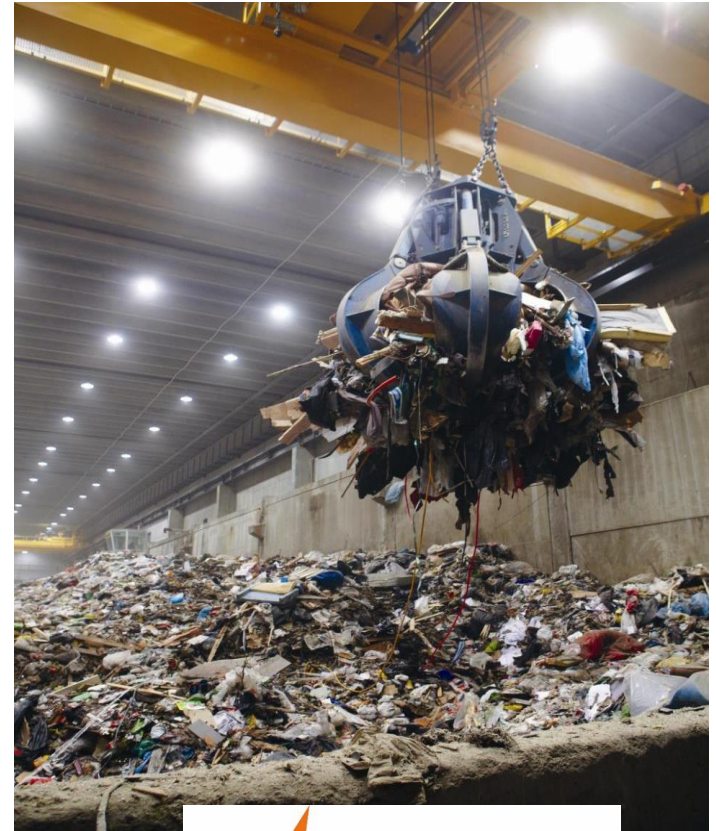
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Sejlsplan 4. Den nord vest indløbs

Carbon capture from non-recyclable waste

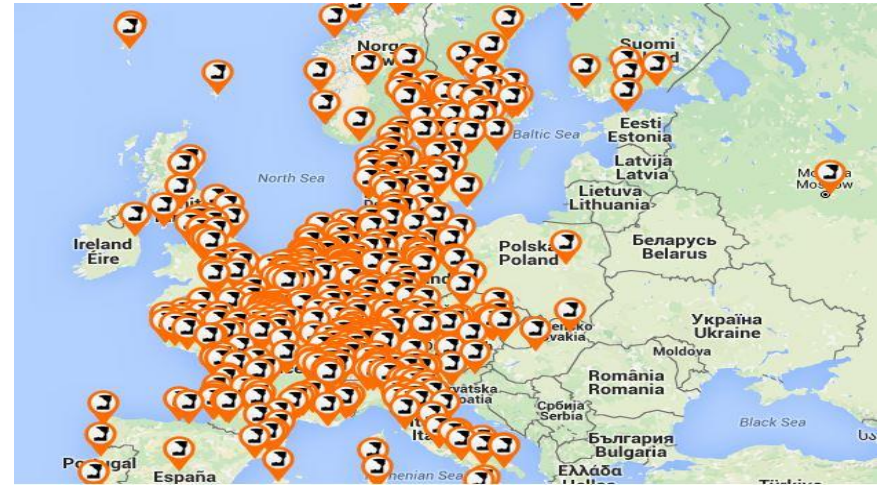
Reduced emissions of GHG in the complete valuechain

1. Waste avoided from landfill – saves methane production and -slip
2. Sorted waste saves CO₂ by replacing fossil products
3. Energy recovered rest waste saves CO₂ in district heating and electricity
4. CO₂ – post incineration capture saves CO₂ for either reuse or storage
5. Carbon criteria in waste tenders will push carbon further up the waste hierarchy
6. Last, but not least – bioCCS



Energy recovery from waste

- Compete to treat waste at lowest possible cost, and maximizing the value of the waste
- Climate benefit a indirect competition advantage – energy efficiency releases energy revenue
- Producing heat and electricity displacing fossil energy
- Approx. 90 mill. tons incinerated in Europe every year
- 98 mill. tons landfilled (EU) every year, - of a total 320 mill. tons.
- Many public stakeholders – strict regulations



- 450 energy recovery plants in Europe, ca. 700 in the world
- Not a part of ETS
- 60% bio-CO₂

Carbon capture at Klemetsrud

- Pilot plant showed CO₂-capture stable and reliable at 90%
- Removing fossil CO₂ (plastics etc.) and biological CO₂ - bioCCS
- Creating and building competence in Norway – large global transferability
- Heat delivery maintained – internal usage of electricity increases
- Business opportunities; CO₂-to the market – increased tipping fees
- CO₂ transportation to port – showcase zero emission vehicles
- Realization well within timeframe of the project
- Realization possible with different tech suppliers
- Can catch 315 000 tons CO₂ pr. yr – approx. 60% carbon negative
- Additional future potential in Oslo alone 450' – 600' tons CO₂/yr

Broad political support in Oslo

Products from Waste to Energy

- Heat – delivers almost 1 TWh/year to the city (90.000 apartments)
- Delivers electricity to the grid – all the schools in Oslo
- 6000 tons of metal recycled pr year

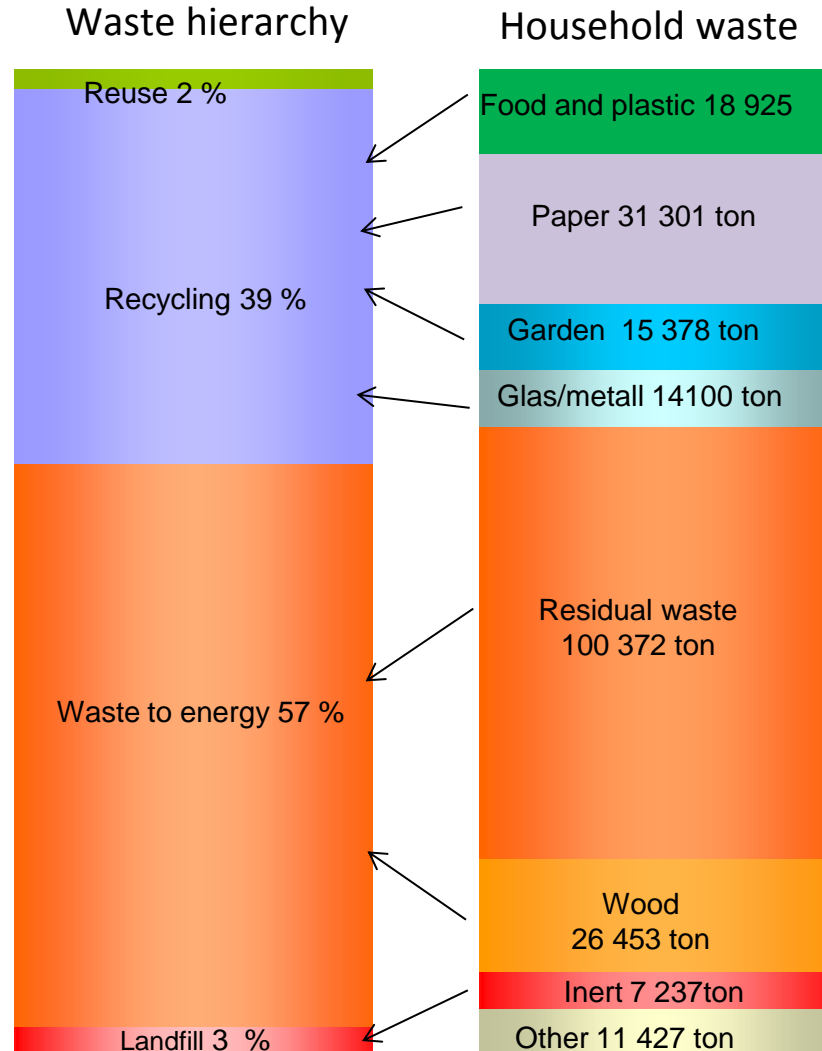
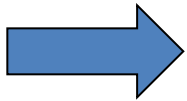


Results

2015: 342 kg waste/inhabitant

- 2 % to reuse
- 39 % to recycling
- 56 % to energy recovery
- 3 % to landfill

Target: 50 % recycling



District heating in Oslo 2006 – 2013

Heatproduction:

2006: 1014 GWh

2013: 1702 GWh



Year	GWh
2 006	1 014
2 007	1 130
2 008	1 194
2 009	1 367
2 010	1 765
2 011	1 533
2 012	1 650
2 013	1 702

District heating covers 20% of the heating need in Oslo

Local and central district heating networks

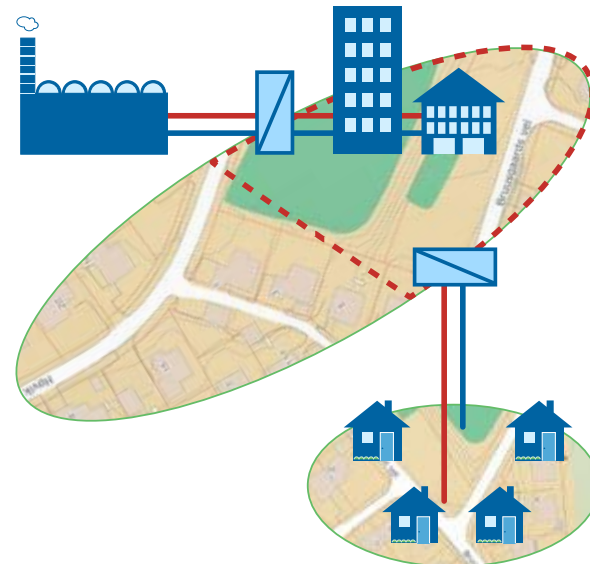


Low temperature district heating networks can use heat from:

- Ice-rink
- Computerhalls
- Cooling systems
- Shops
- Solarheating systems

Local and central nets integrated

Heat is transferred from the central system when needed, during winter and cold days



Thank you for your attention!

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