Increasing the Sustainability of Transmission & Generation Assets

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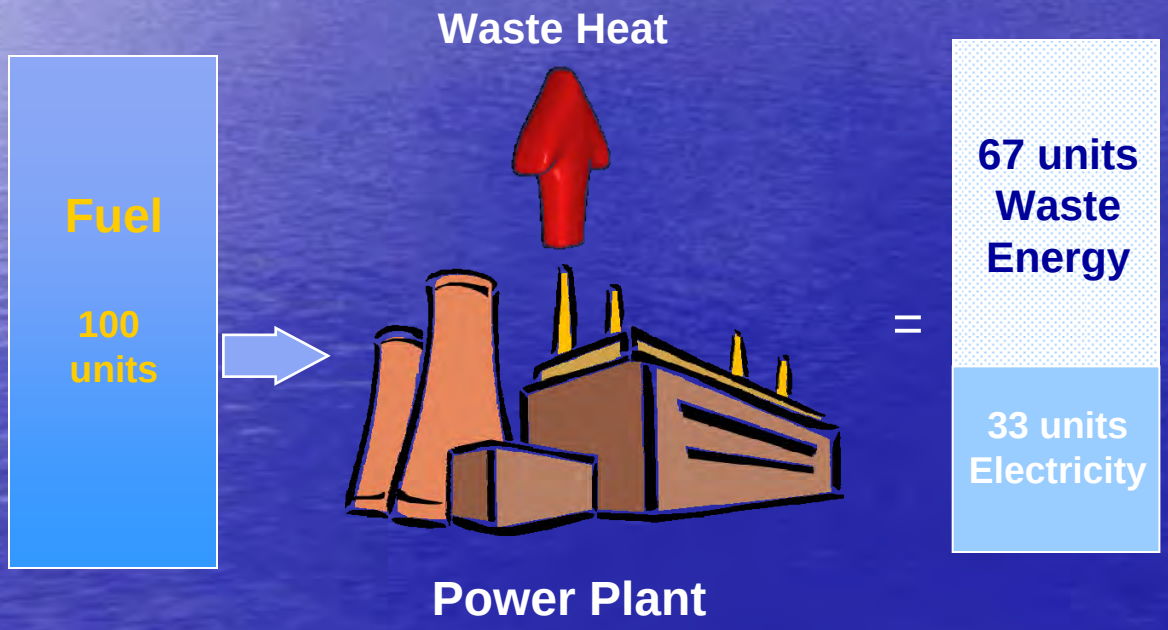
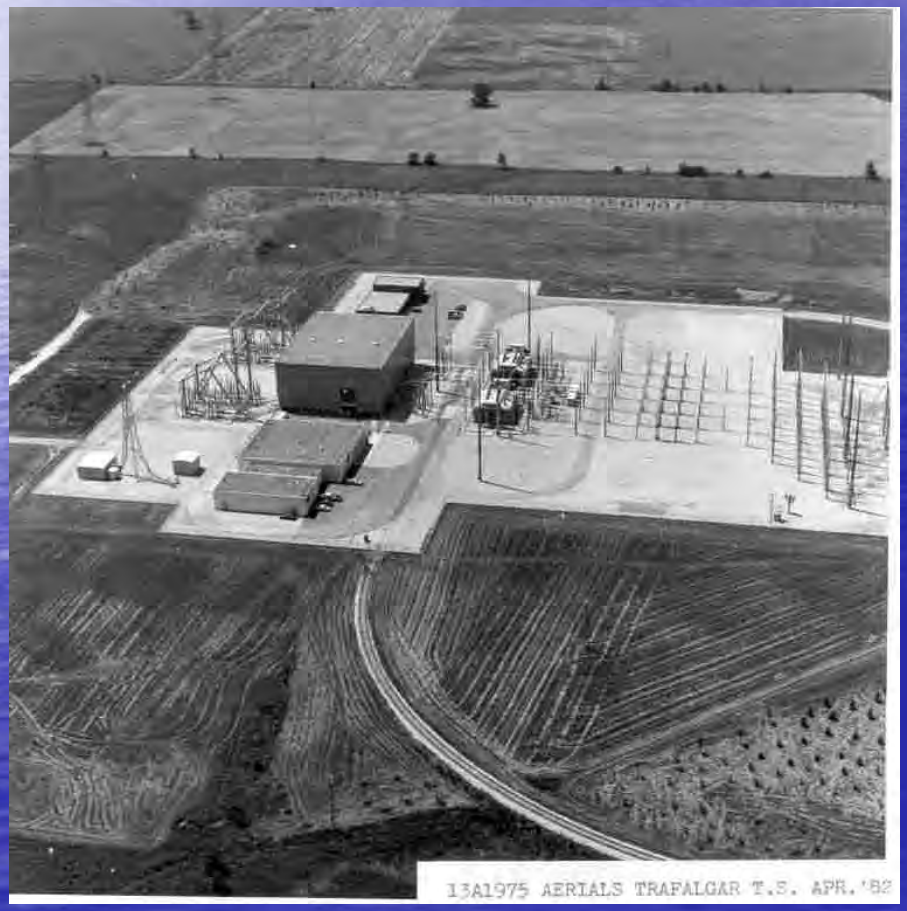
Increasing the Sustainability of Generation Assets

Waste Heat is the Opportunity



Transformer Stations

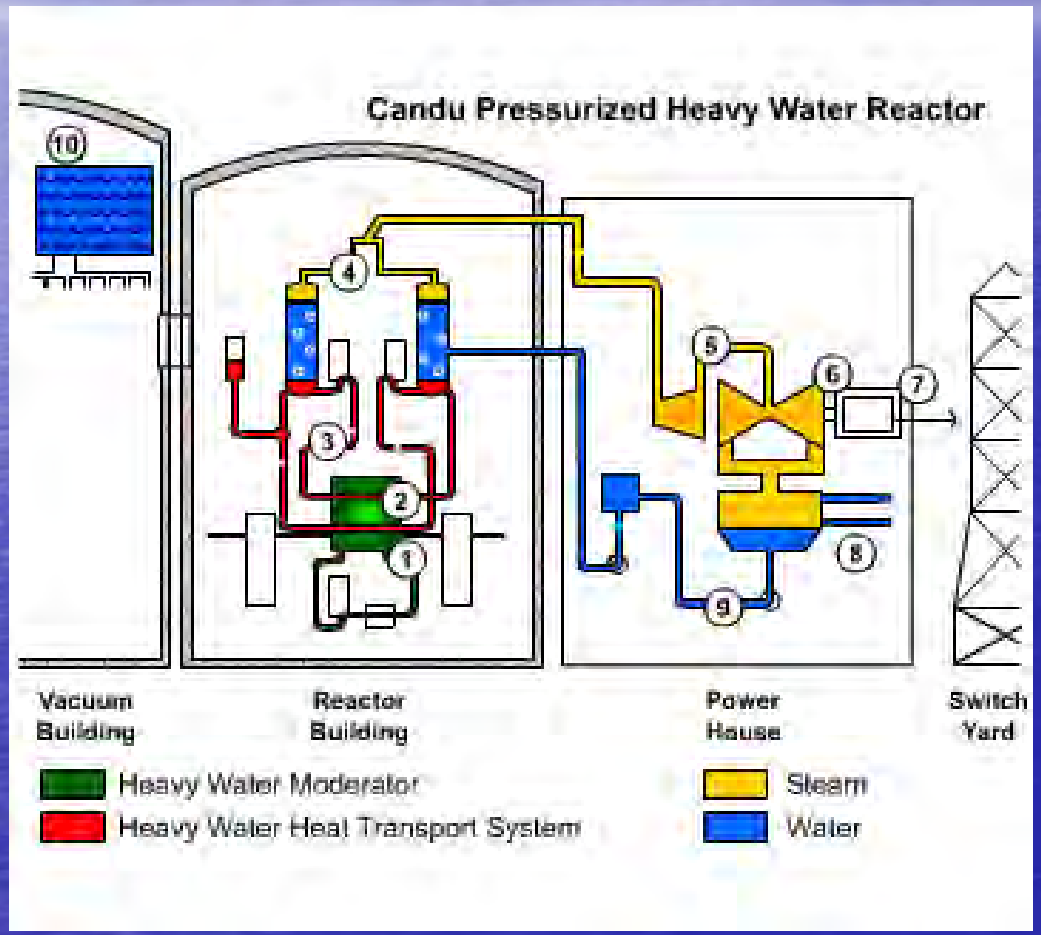
- **Typical Site**



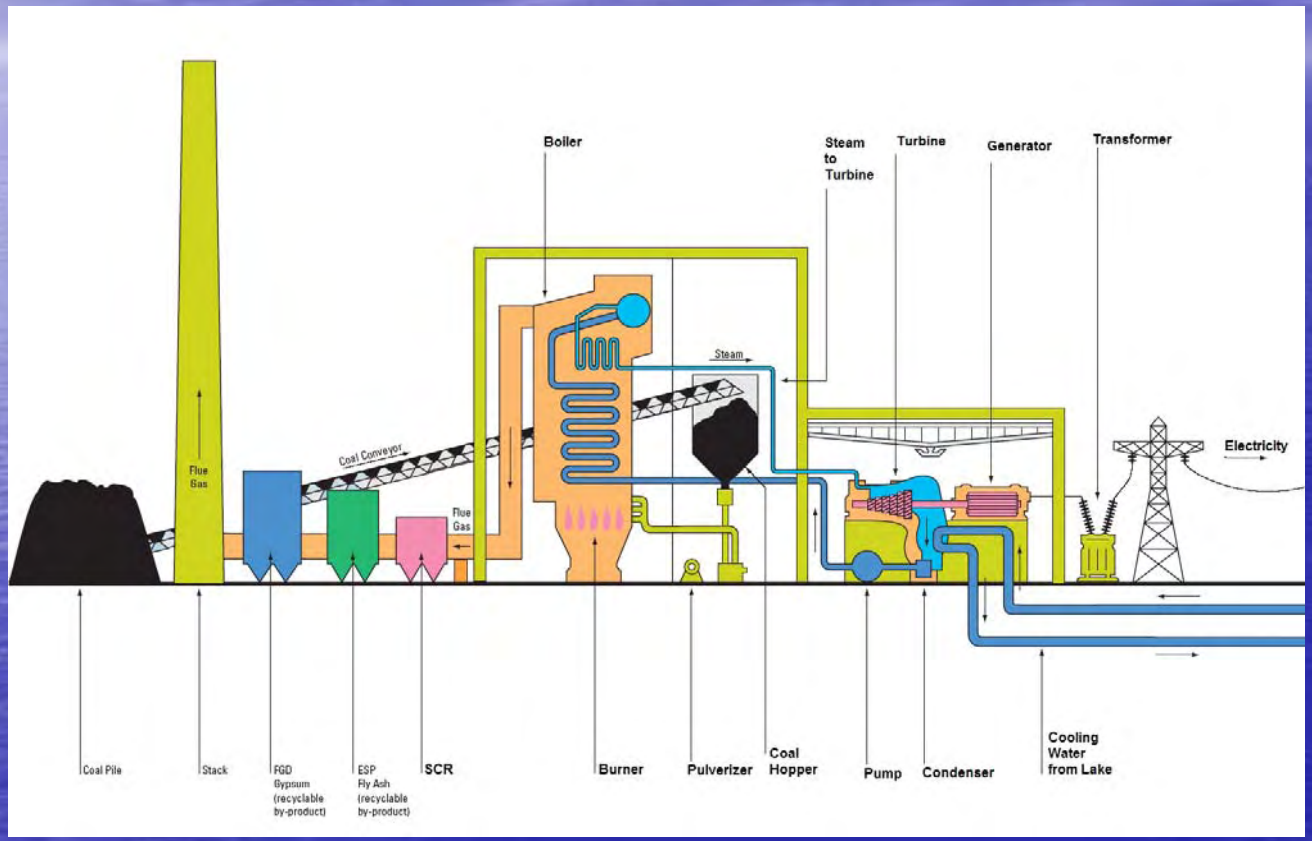
Increasing the Sustainability of Generation Assets

Nordic countries like Finland, Iceland, Norway and Sweden, have increased overall electricity generation efficiency from less than 40% to over 80% by reclaiming waste heat for space heating.

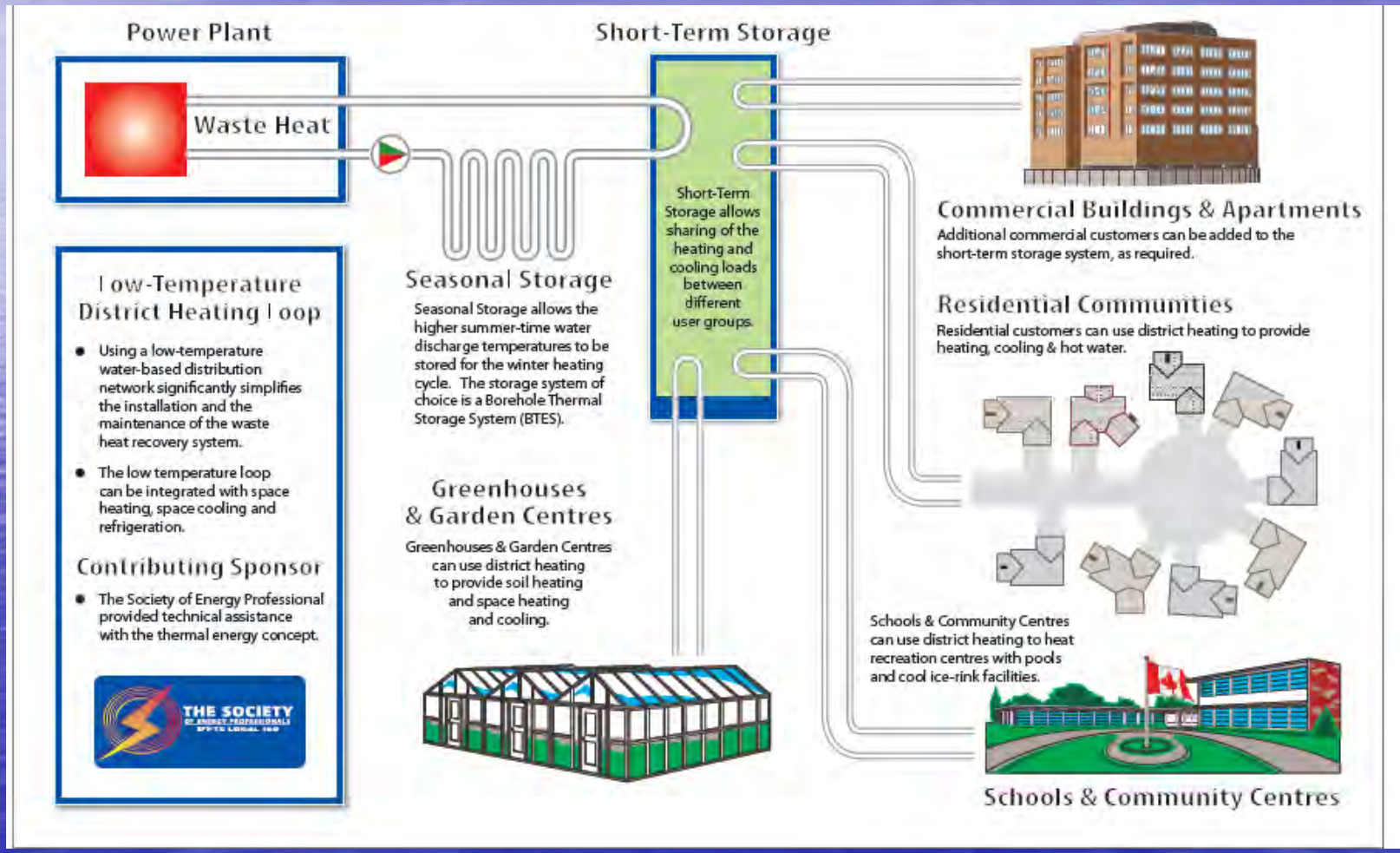
Examples of Central Plants



Examples of Central Plants



Low-Temperature District Heating and Earth Energy Systems

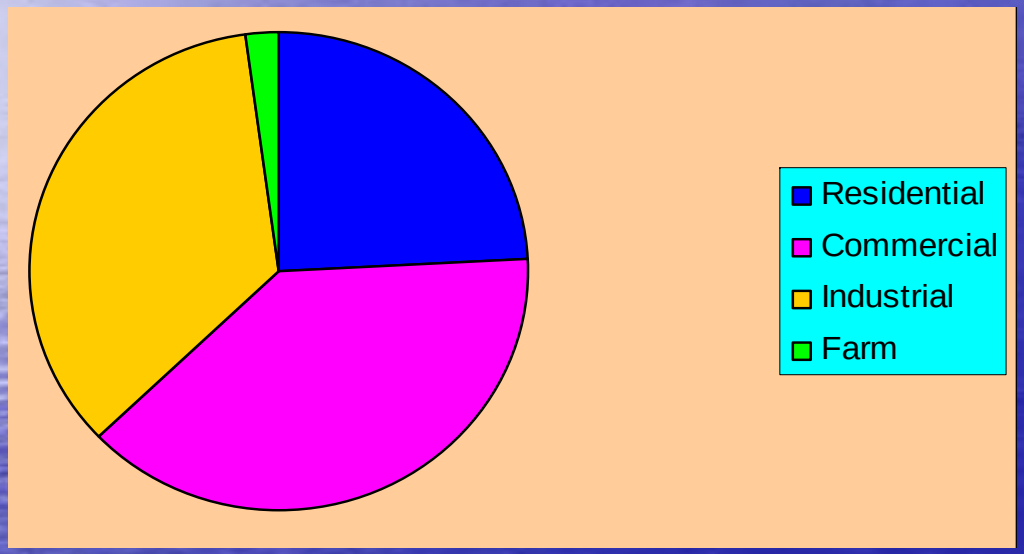


Low-Temperature District Heating (LTDH)

Target Markets for LTDH

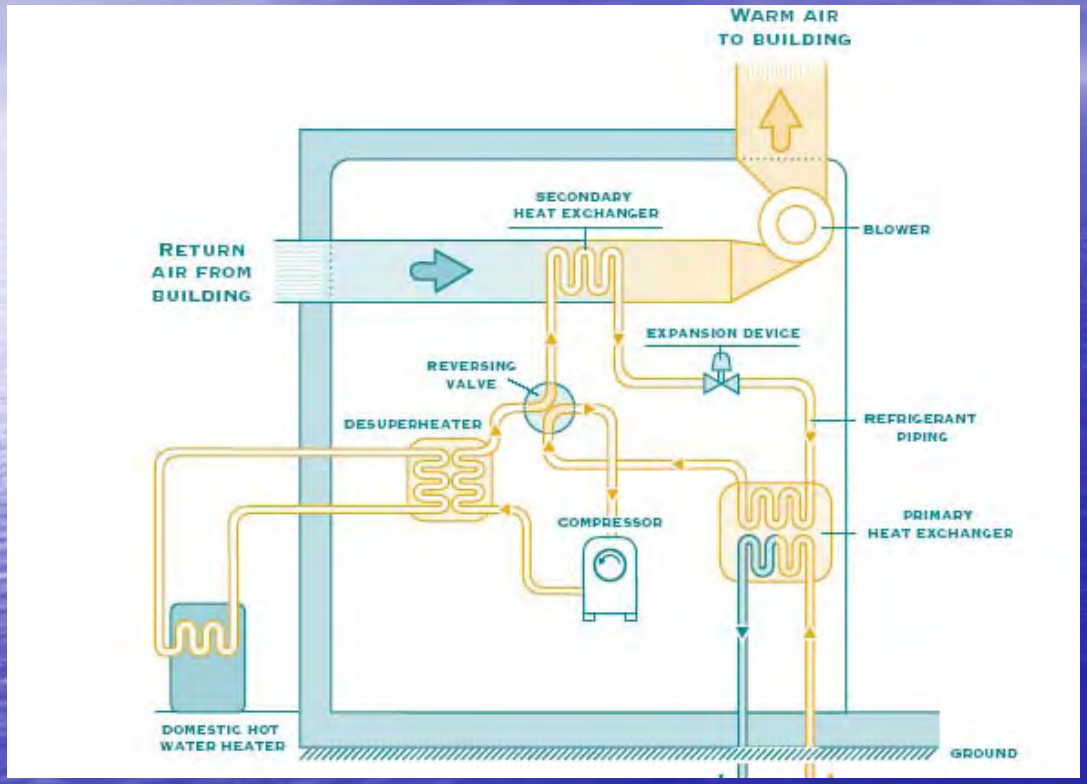
- Agricultural soil heating
- Aquaculture
- Irrigation
- Residential Space Heating and Cooling (includes pool heating and water heating)
- Commercial Space Heating and Cooling
- Industrial Space Heating and Cooling
- Institutional Space Heating and Cooling
- Multi-Residential Space Heating and Cooling
- Indoor Sport Centres, including swimming pools, ice rinks, gymnasiums and other recreational facilities.
- Outdoor pools and stadiums park walkways etc.
- Snow melting on select roads and/or intersections (winter)

Increasing the Sustainability of Generation Assets



Where the electricity is used

Low Temperature Heat Pumps

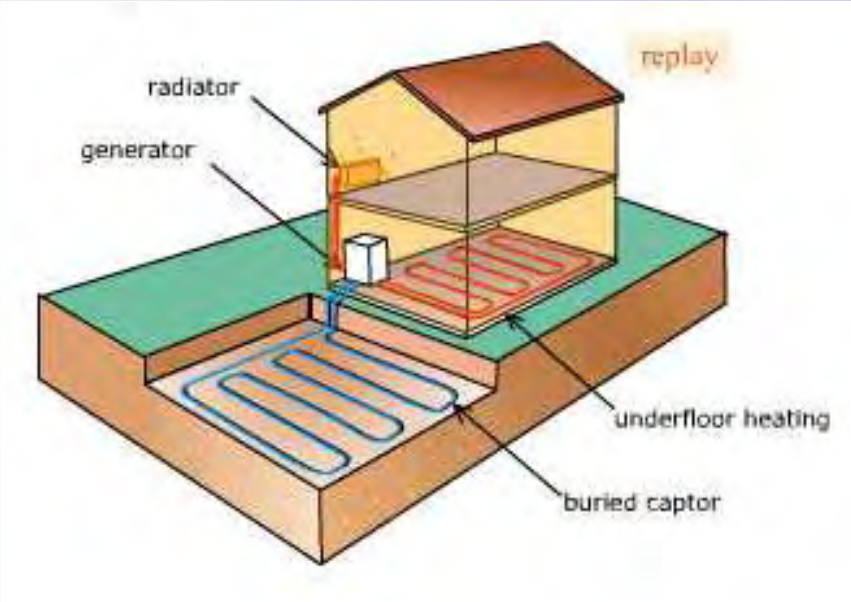


Earth Energy Heat Pumps Deliver 3x more!

Used to boost the waste heat output

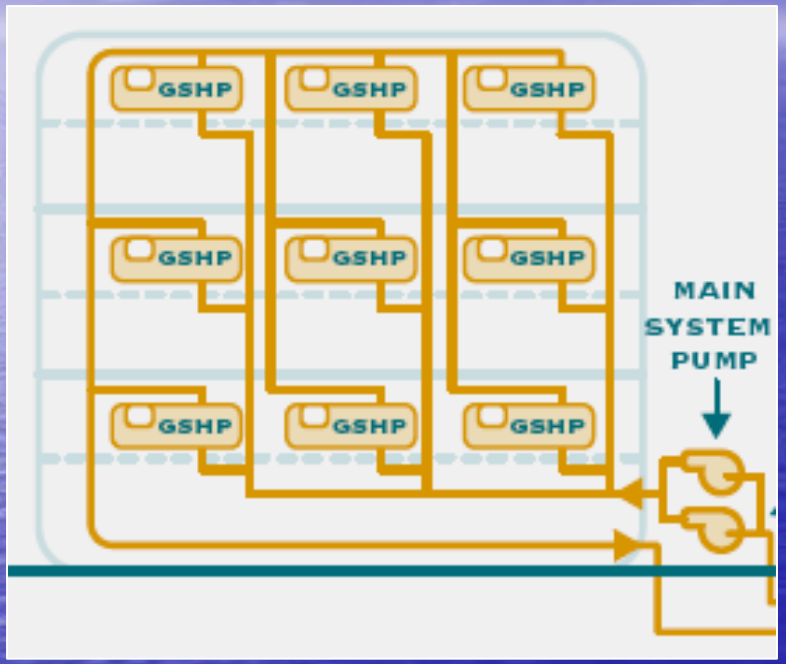
Be a Power *Saver!*
With Earth Energy

Earth Energy Technology and Green-Heat



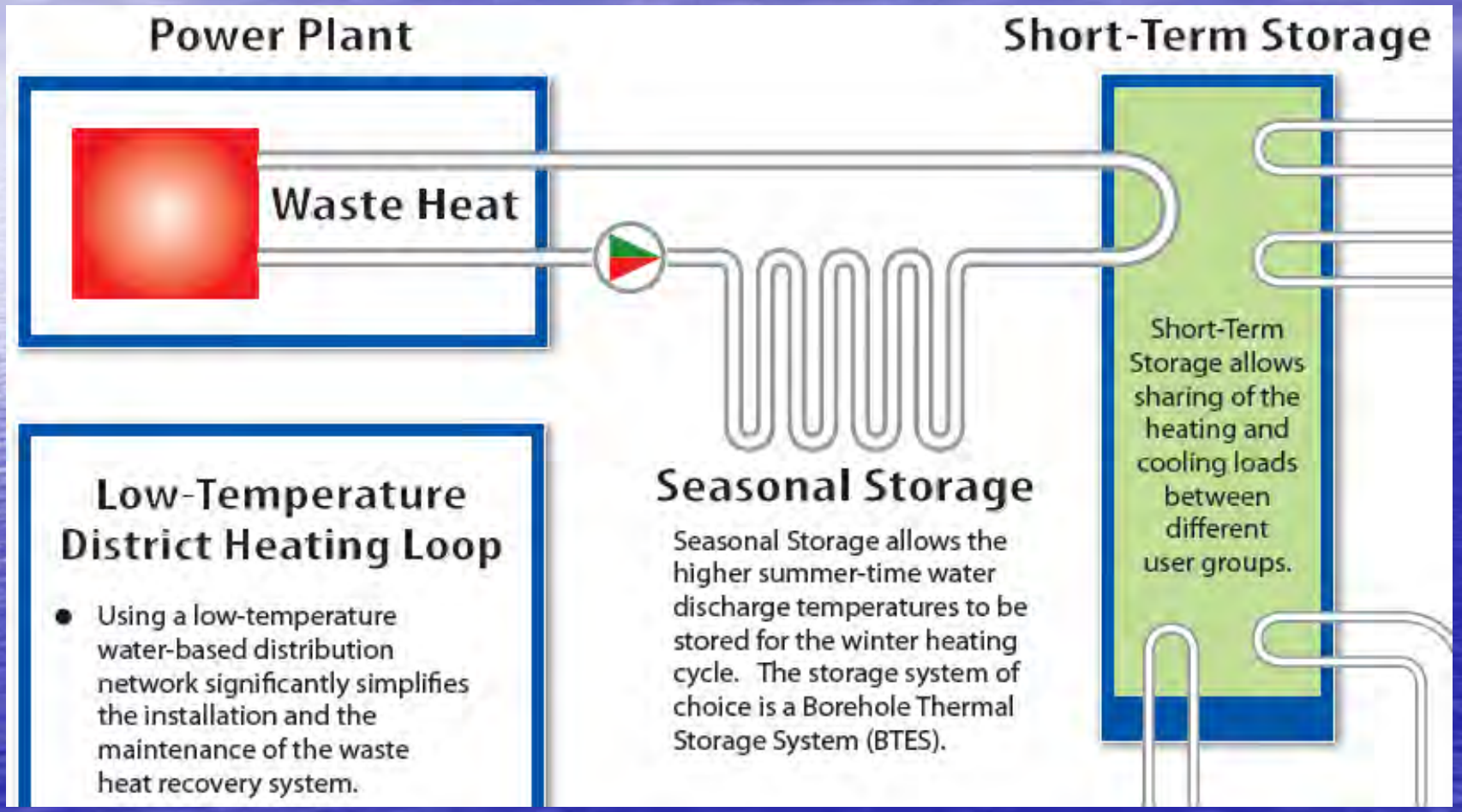
- Typical residential home has a heating load of ~10 kW peak, consuming ~20,000 kWh/year.
- The summertime cooling load is ~7 kW, rejecting ~10,000 kWh/year of thermal energy and consuming ~3000 kWh/year of electricity.

Schematic Showing Water-Source Heat Pumps inside a Commercial Building

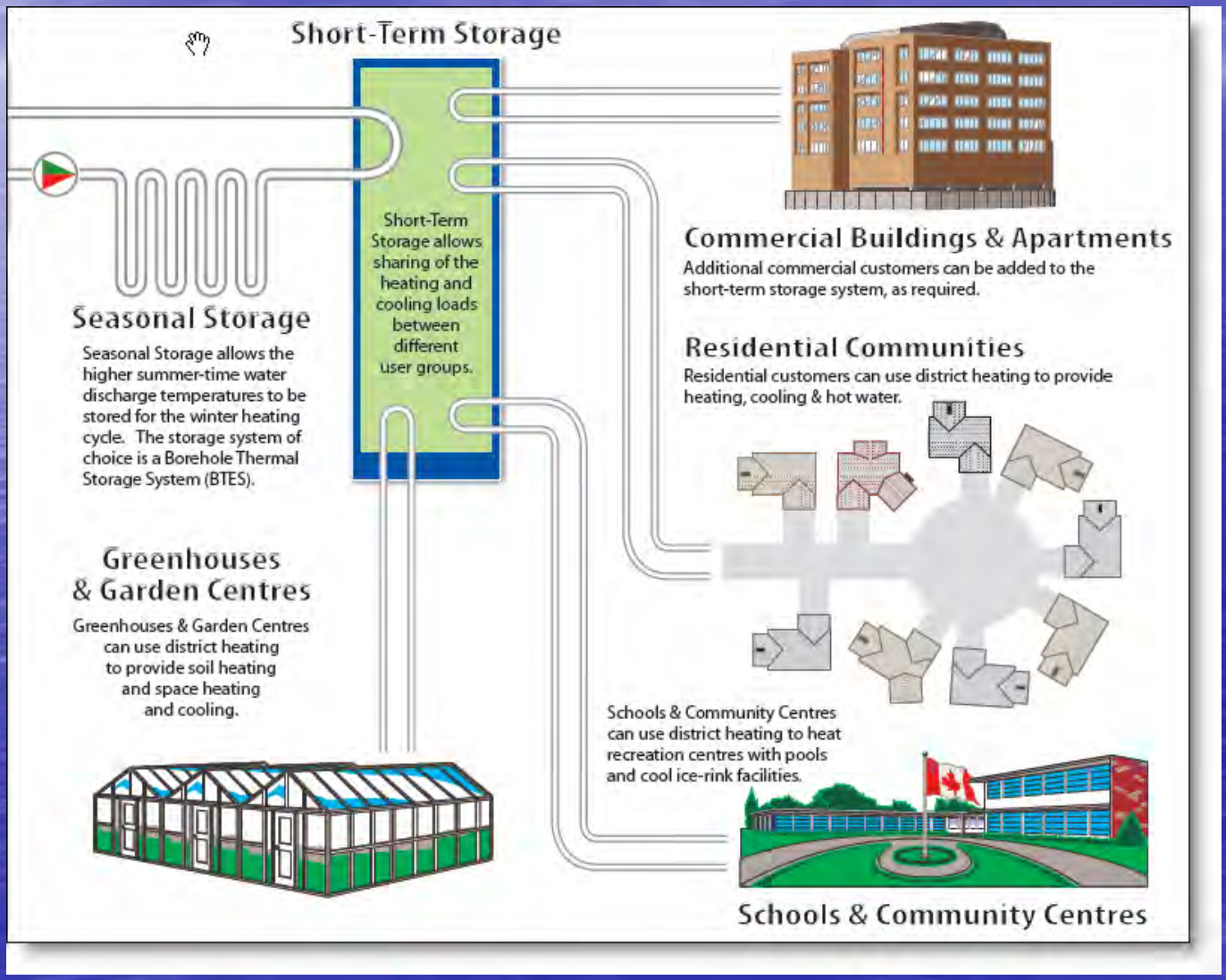


- Typical commercial building of 1000 m^2 has a 100 kW peak heating load
- Consumes 200,000 kWh/year.
- Summertime cooling load is ~100 kW, rejecting 150,000 kWh/year.

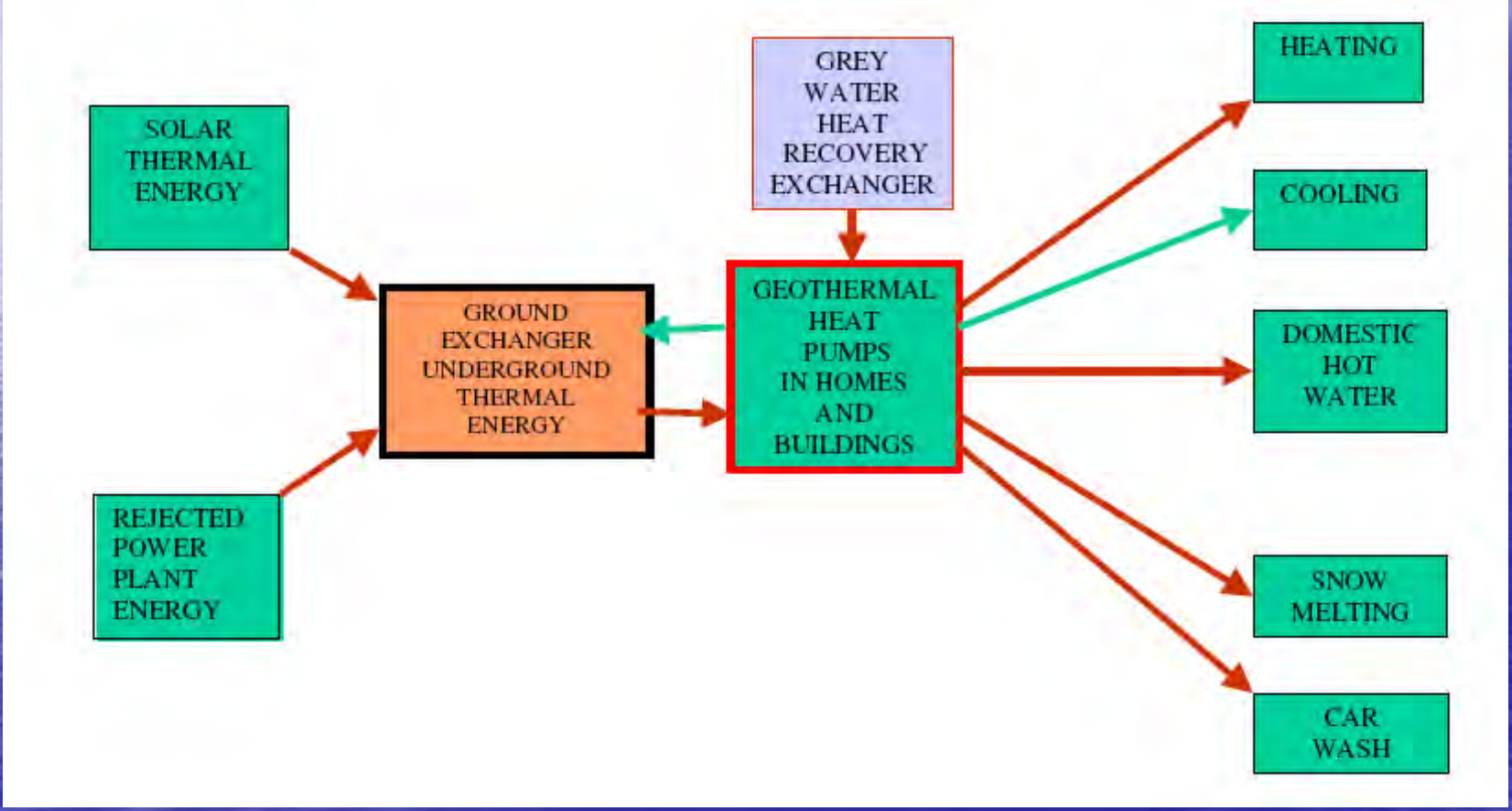
Low-Temperature District Heating (LTDH)



Low-Temperature District Heating and Earth Energy Systems



Intelligent Heat Recovery and Storage System Flow Diagram



Conclusions

The low-temperature district heating (LTDH) loop concept can:

- Lower electric peak-demand by over 35 percent
- Provide all the benefits of an earth energy system (EES) at a much lower capital cost

Based on a total LTDH loop cost of $800,000, the number of dwellings needed for a 5-year payback could be as low as 400 homes and 20 commercial buildings.

For commercial buildings and industrial applications capital costs are expected to be 28% less than the conventional gas-fired/electric heat/cool units.