

An aerial photograph of a city, likely Tokyo, showing a dense urban area with many skyscrapers and a large body of water in the background. The image is slightly hazy, suggesting a distant or elevated perspective. A semi-transparent white box with a halftone pattern is overlaid on the center of the image, containing the title text.

1G/2G to 4G? Challenges in the Existing District Energy Infrastructure in Japan

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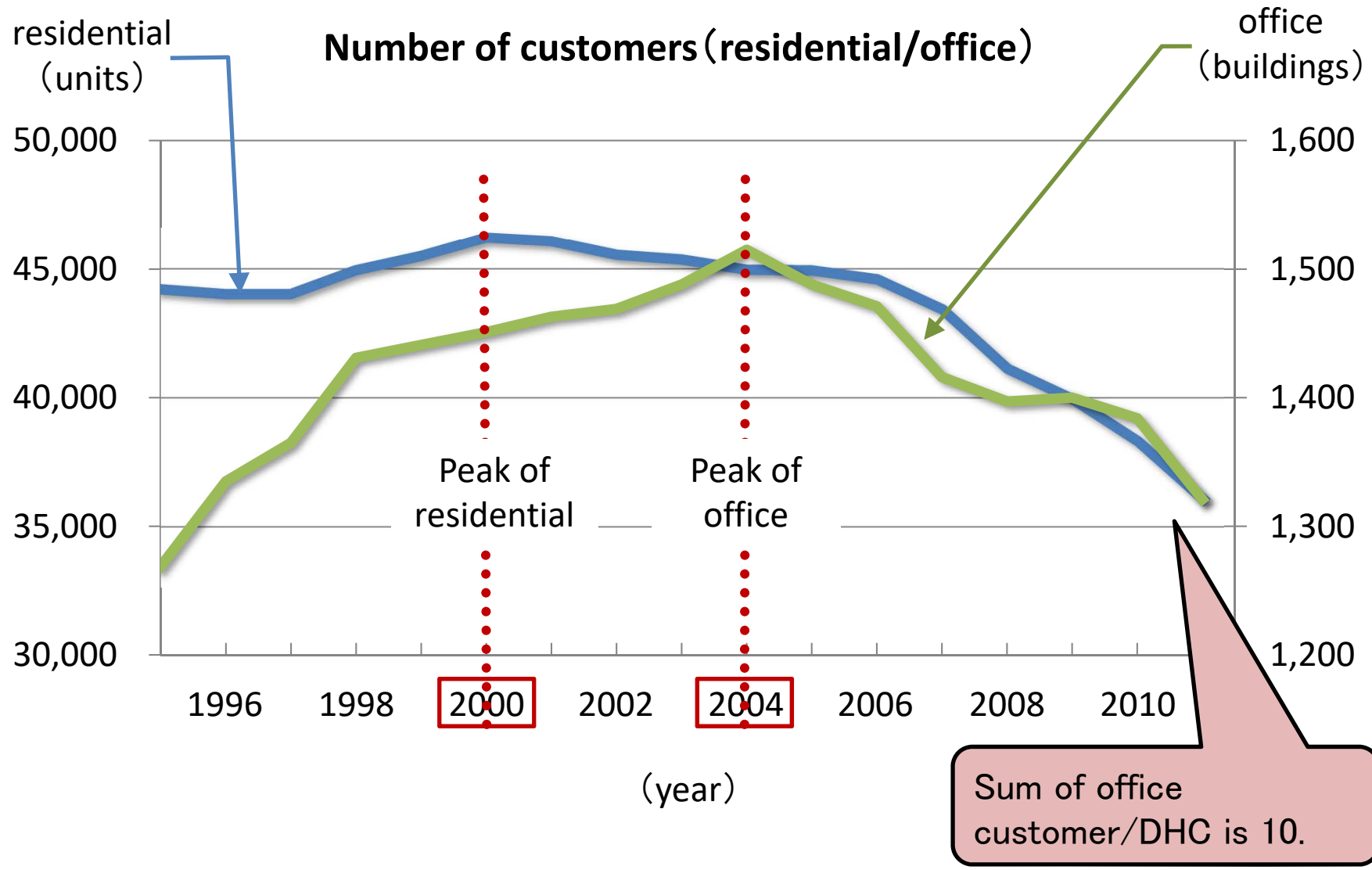
- ✓ **136 DHC districts are existed.**
- ✓ **Customers are mostly limited.**
- ✓ **Customers are mainly offices, retails and hotels, but residential units.**
- ✓ **Chilled water is popular even in the winter.**
- ✓ **Air-conditioner is popular even in the office buildings.**



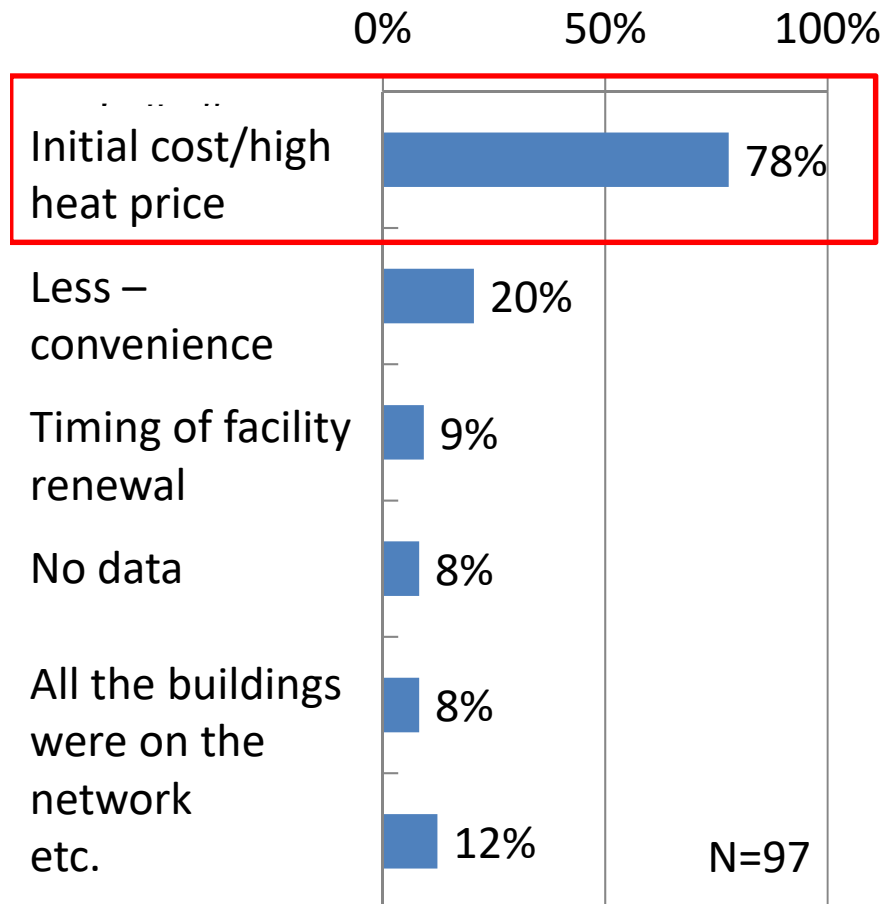
I. Issues of DHC in Japan

II. Cases in Sapporo Downtown

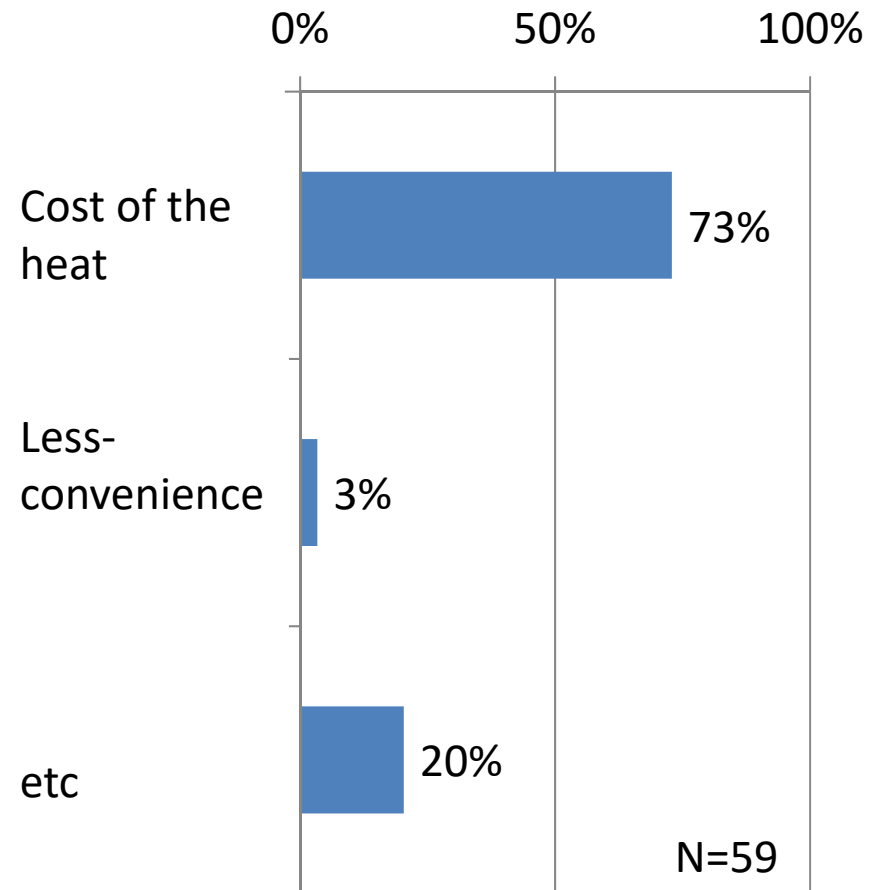
Issue 1: Number of Customers is Declining



Issues to receive new connections



Issues to renew the contract

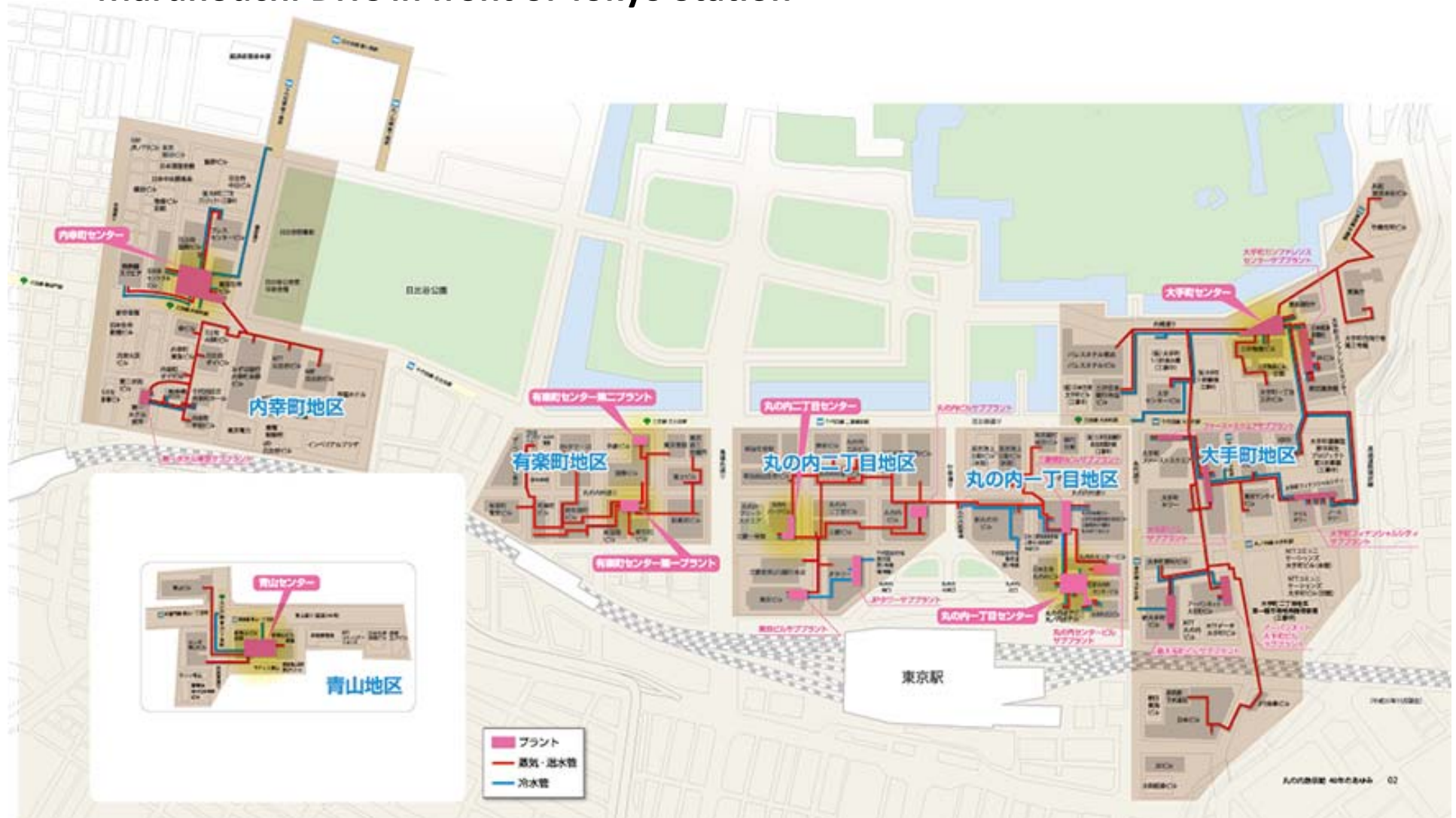


✓ Cost of the heat is the issue.

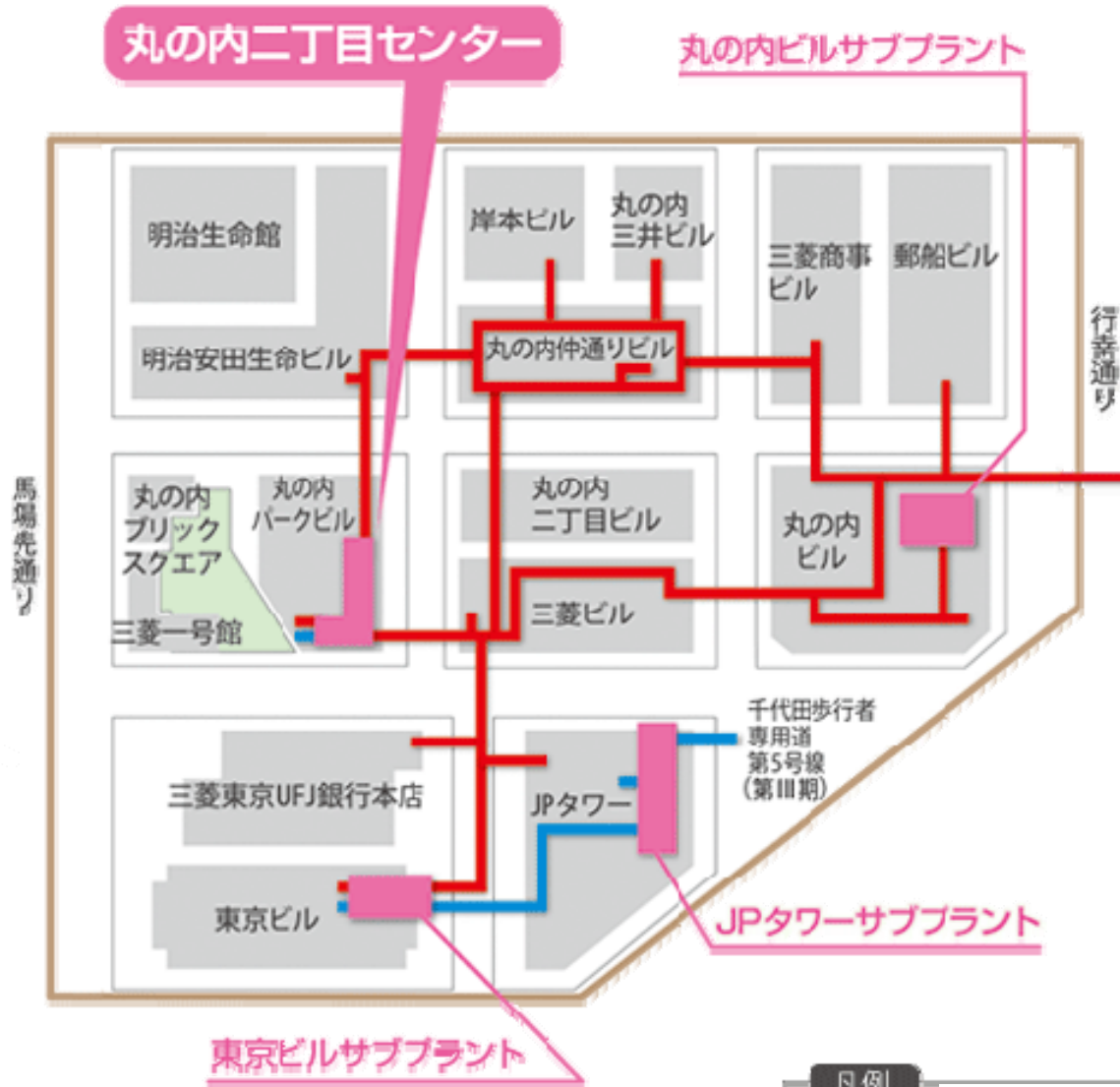
✓ Under the Road Act, DHC is not define as an utility, because of this, where DHC pipes are running is an issue.

- ❑ More than half cases, pipes put in a private lot, and that affects to the heat price.
- ❑ Getting a permission of pipes is difficult.
- ❑ Piping cost is about 1,000,000 yen/m (5800 kr/m) in the large cities. Gas network is just 100,000 yen/m (580kr). Because under the street is congested, DHC companies need to dig the road about 4m in depth.

Marunouchi DHC in front of Tokyo Station



Area served : 111ha building system served: 68 buildings & 6,380,000m²
Energy Centre floor spaces: 41,000m² Chiller 113,243 RT, boiler 622T/h, HP 576 RT

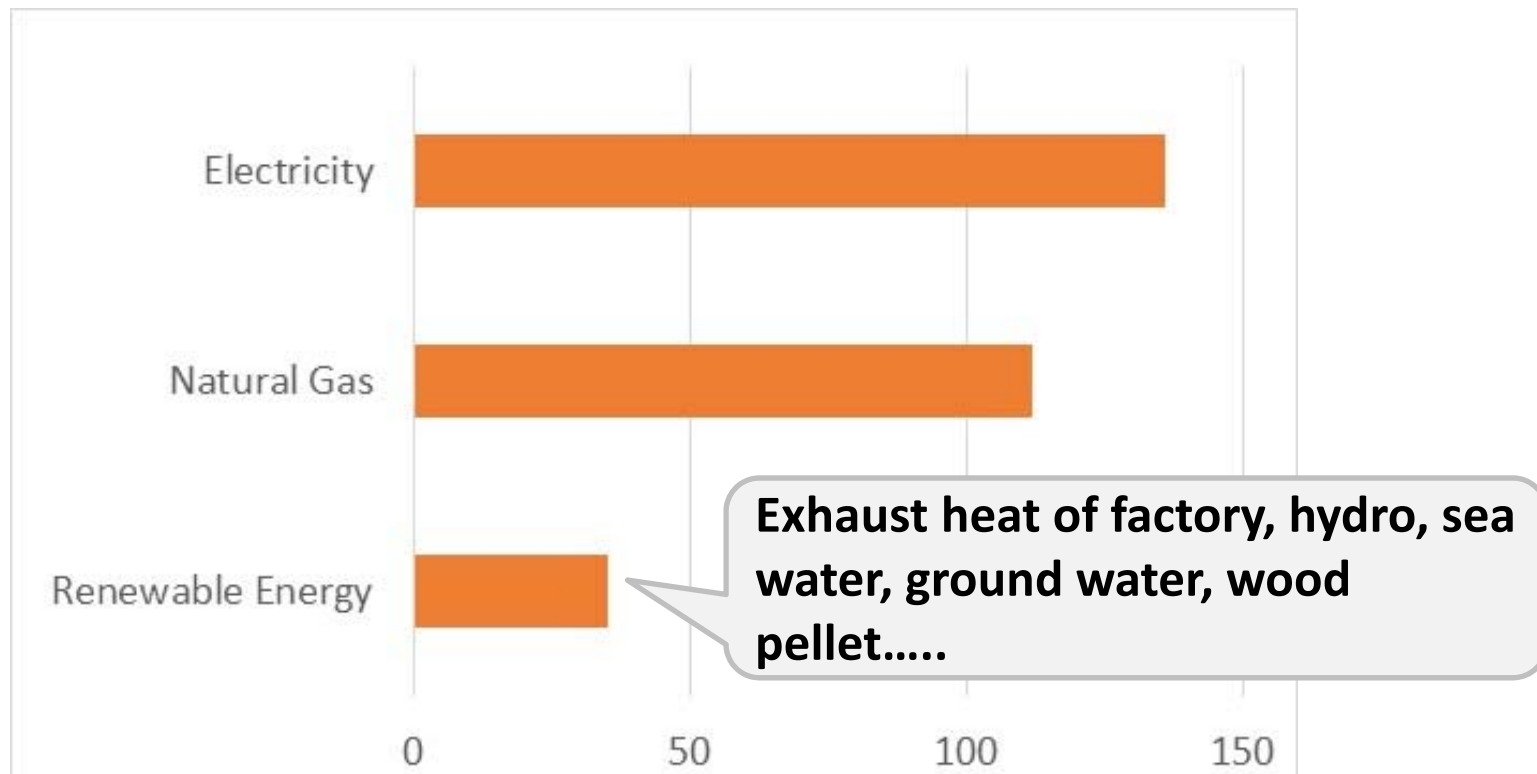


- 凡例
- Energy centre
 - Steam
 - Chilled water

- **Public sectors charge use of the road (price is different by the area).**
- **The price is set by each municipality. Downtown Tokyo area cost 2700 yen/m (159kr/m), but Sapporo City does not charge for DHC companies.**
- **Gas, electricity, telecom networks, they are not charged because they are utility under the Road Act.**

- ✓ Under the previous Heat Supply Business Law, heat price and DHC service area was difficult to change. Firstly DHC companies required to negotiate with METI (Ministry of Economy).
- ✓ Under the amendment of the Law, liberalisation was introduced to the heat market as well. Cost of the Infrastructure is high, but the Law said that infrastructure should be open to the new DHC companies.

- ✓ Use of Renewable Energy for DHC is increasing, but total number is limited.
- ✓ Old networks have steam system.
- ✓ It is far from the 4th generation.



Reclaimed water use from Sewage Treatment Centre



Incineration of sewage sludge fuel



Snow for cooling



Waste from Construction site





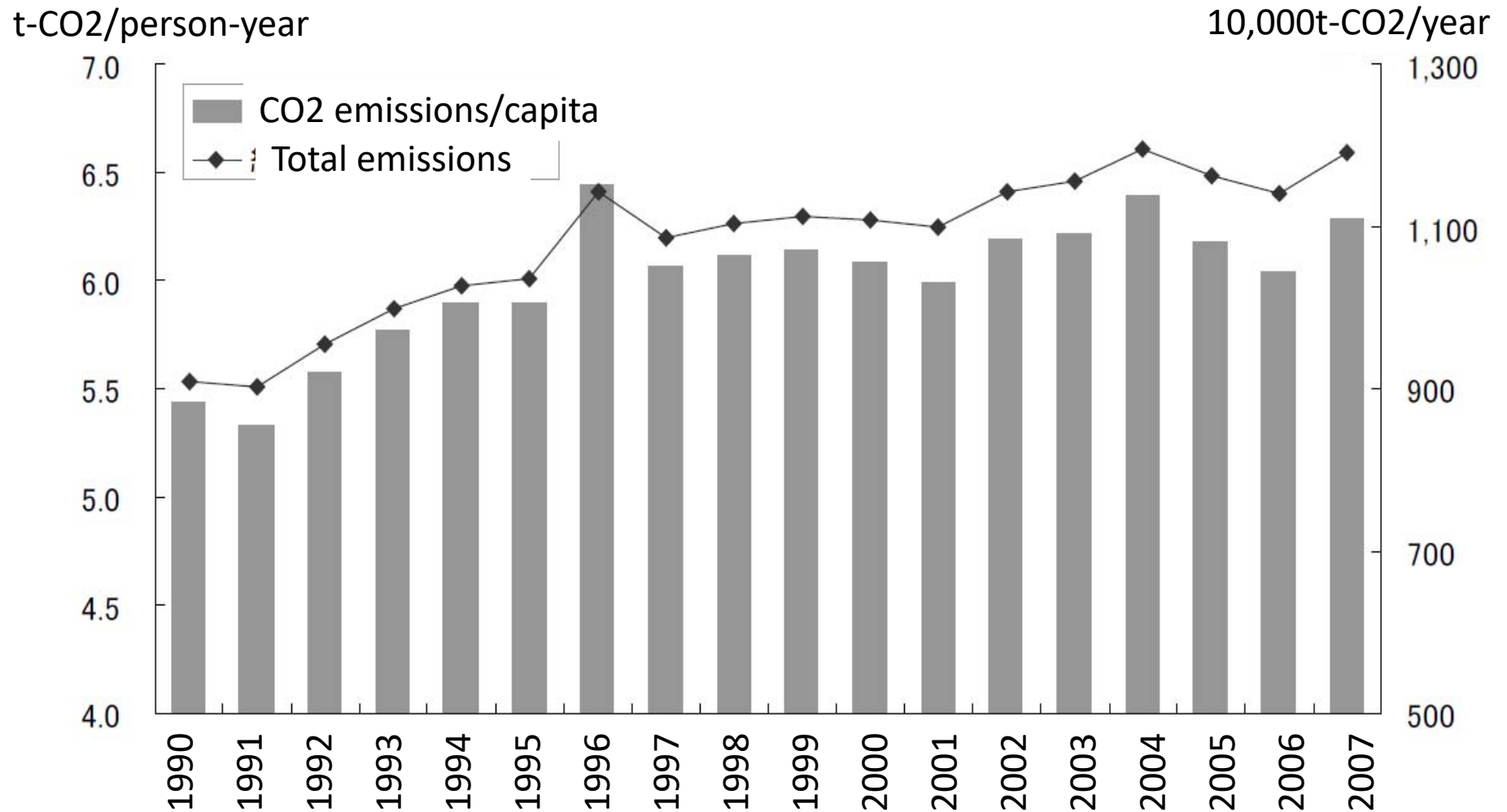
II. A case in Sapporo Downtown



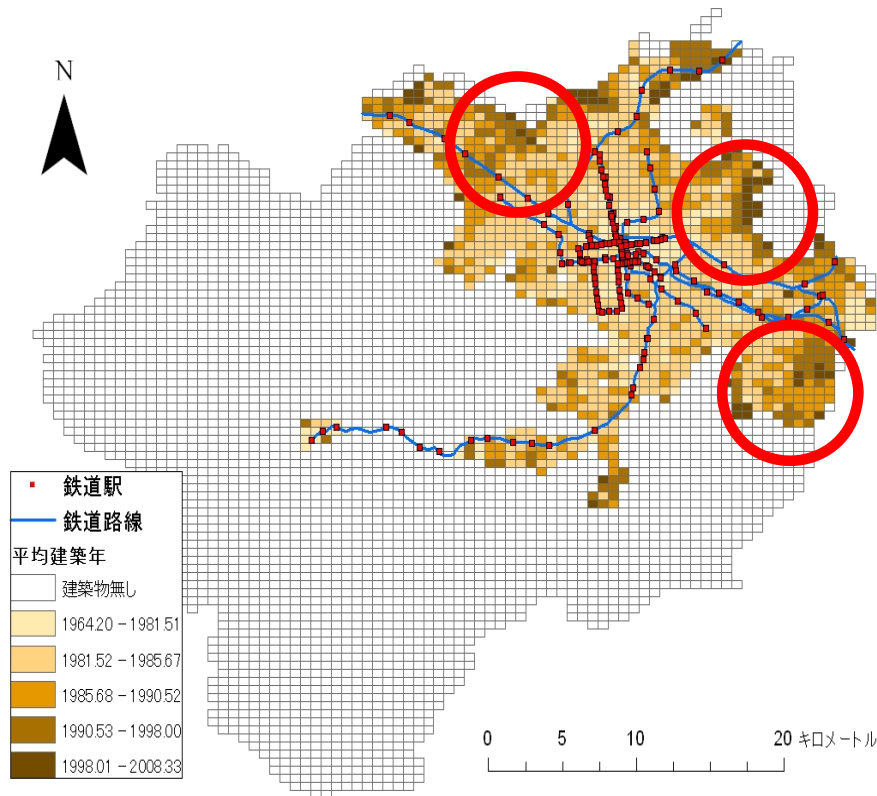
- ✓ Largest northern city in Japan
- ✓ Population size is 1,914,000 (2014)



Trend of CO2 emissions in Sapporo City

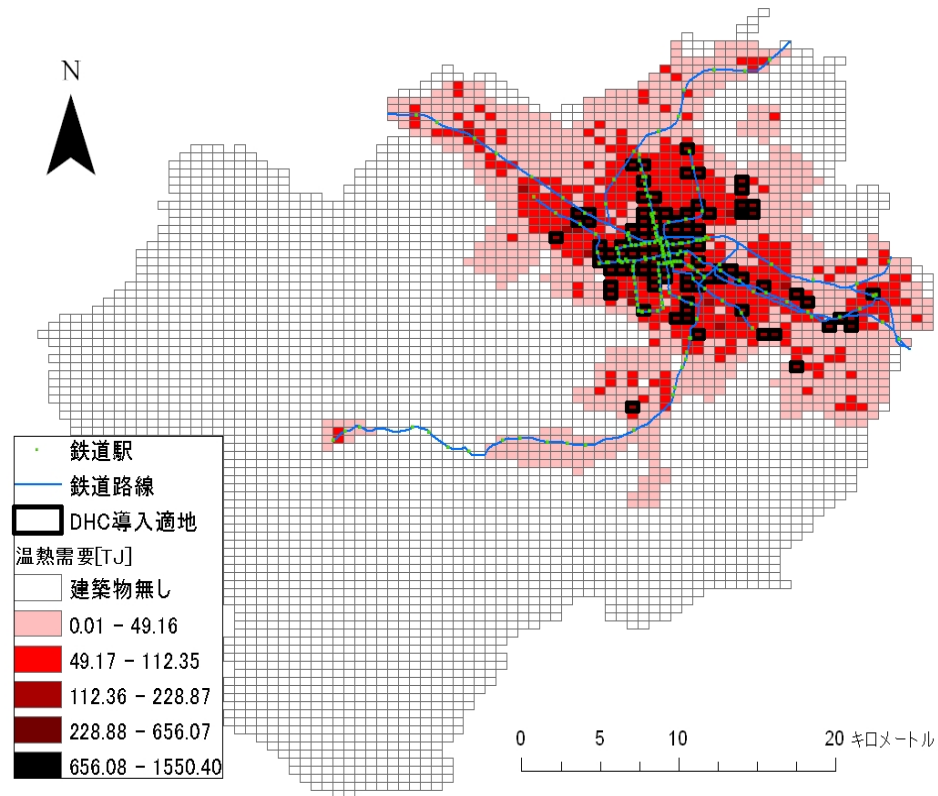


source) Sapporo City



Age of buildings

▶ New buildings are developed in the suburbs.

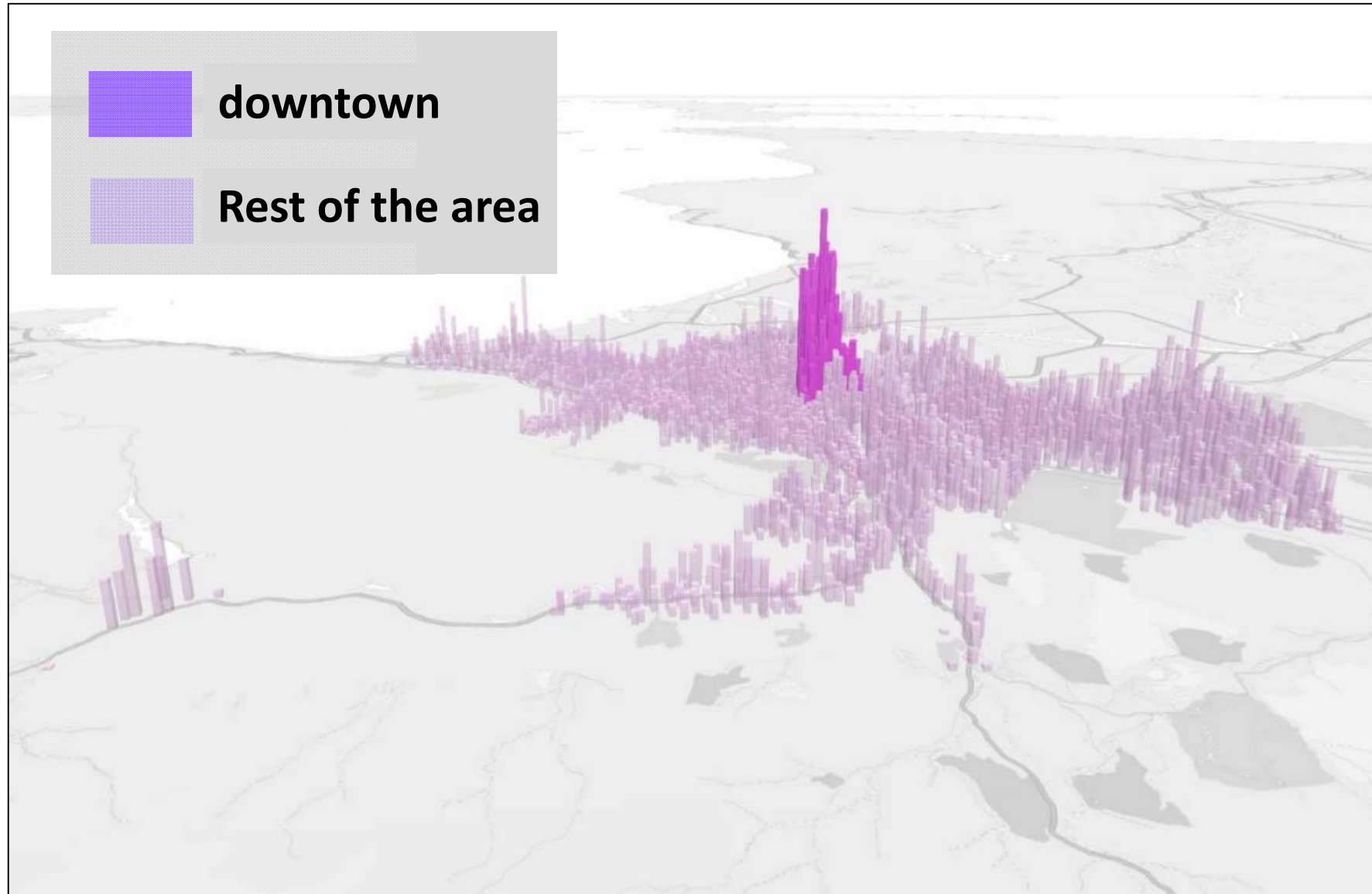


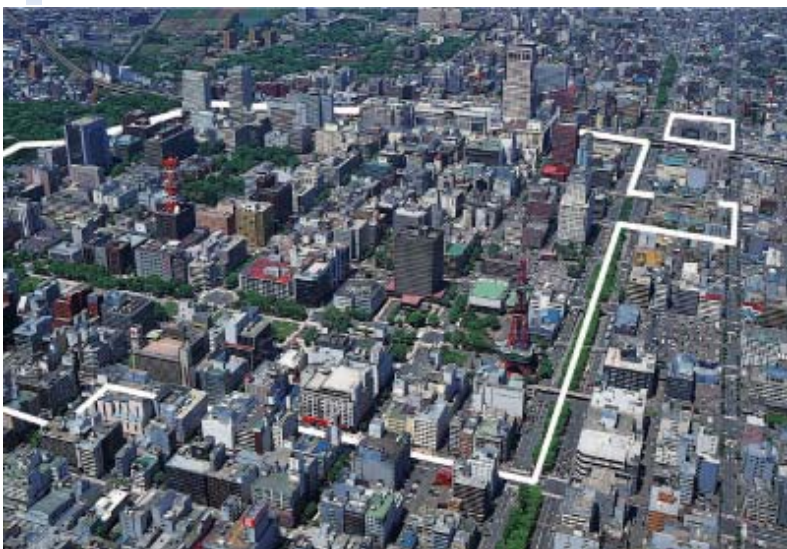
Heat demand

▶ Heat demand is concentrated in the downtown.

Heat Demand is High in the Downtown Sapporo

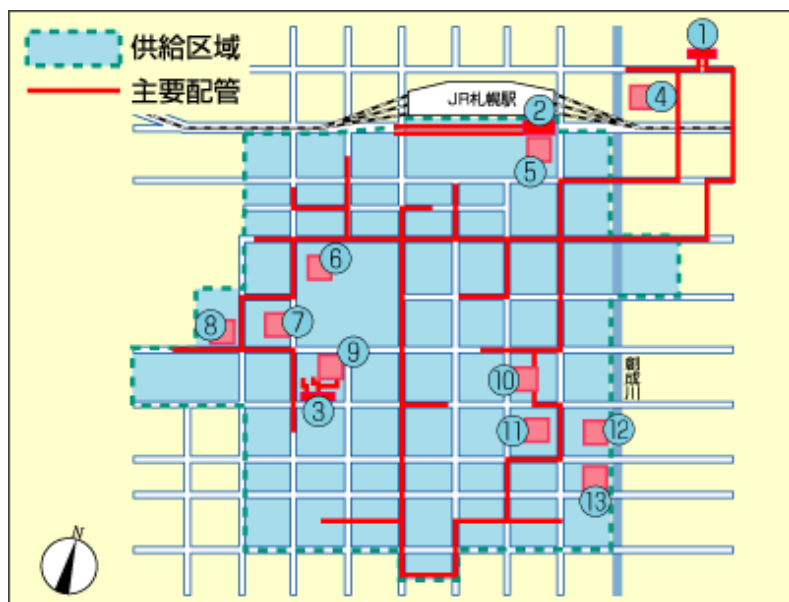
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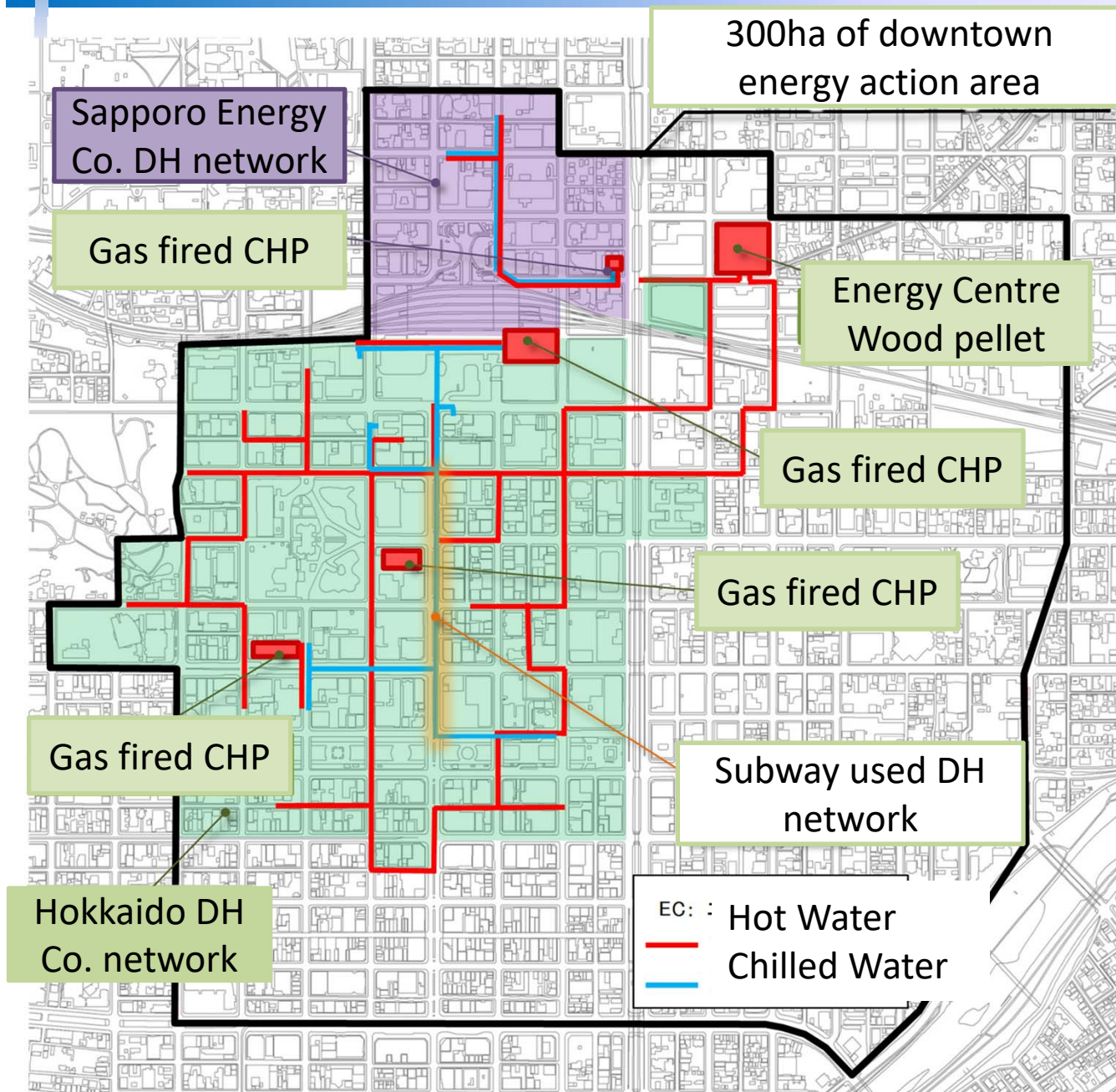
background

- DHC company was established in 1971 for the Sapporo Winter Olympic Games, because of severe air quality.
- Biomass (wood chip) system was introduced in 2009, and main energy centre has gas CHPs. They covered 106 ha, 44km network and 60% of building floor spaces are covered.



Downtown Energy Plan preparation has started

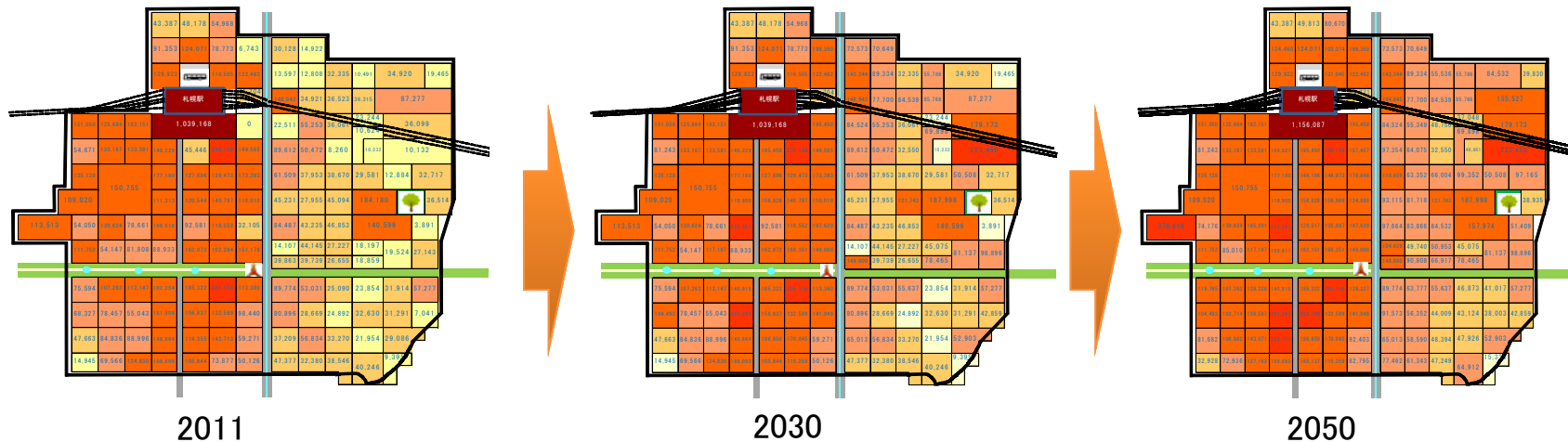
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- ✓ Preparation has started for 5 years.
- ✓ Local gas, electricity, DHC, real estate, bank, chamber of commerce, BID, central government, related departments in house, and academics invited for the meeting.
- ✓ Action plan preparation is stated since 2017.

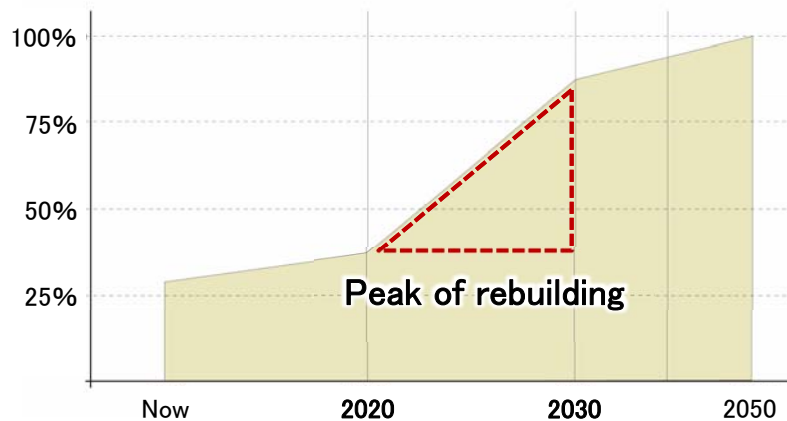
Buildings and Energy Use in the Future

- The size of buildings will be larger. Therefore, demand of energy will be increased.



- Reconstruction will be increased.

Green buildings and reduction of CO2 should be essential.

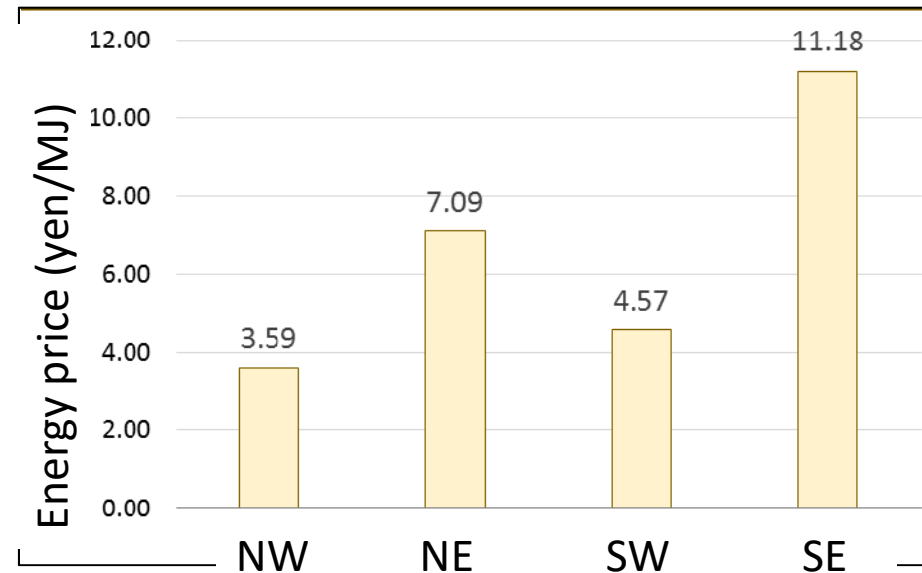
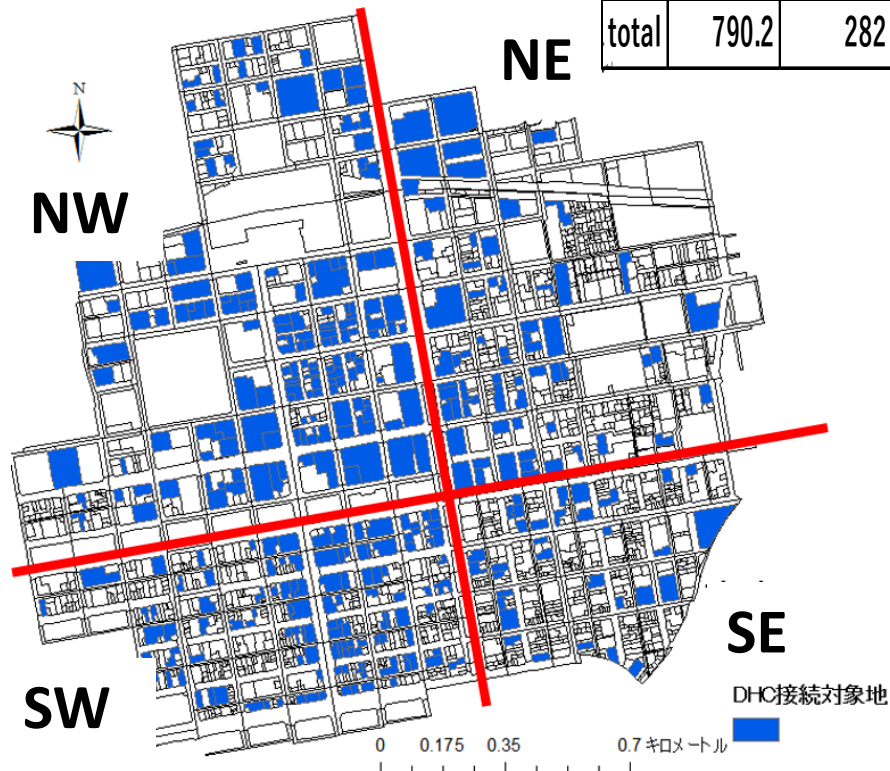


What kind of CO2 emission reduction policies should they establish for 2020–2030?

DH network connection of Buildings over 3000m2

- ✓ All the area of Energy demand is over 4.2TJ/ha
- ✓ Possibility can be seen in the SW.
- ✓ Lots are small in SE.

	lot size 1000m2	No. of buildings	floor area (1000m2)								Electricity Demand (TJ)	Heat Demand (TJ)	Heat Density (TJ/ha)
			office	retail	hotel	hospital	culture	housing	etc	total			
NW	468.2	105	1082	233	383	0	2	55	35	2258	848	807.9	17.3
NE	154.5	48	192	9	31	41	2	55	74	557	131.9	161.6	10.5
SW	117.4	98	293	411	72	17	2	32	19	964	492.6	402.3	34.3
SE	50.1	31	47	8	6	8	6	72	4	201	50.8	66.4	13.3
total	790.2	282	1614	661	492	66	12	214	132	3980	1523.3	1438.2	75.4

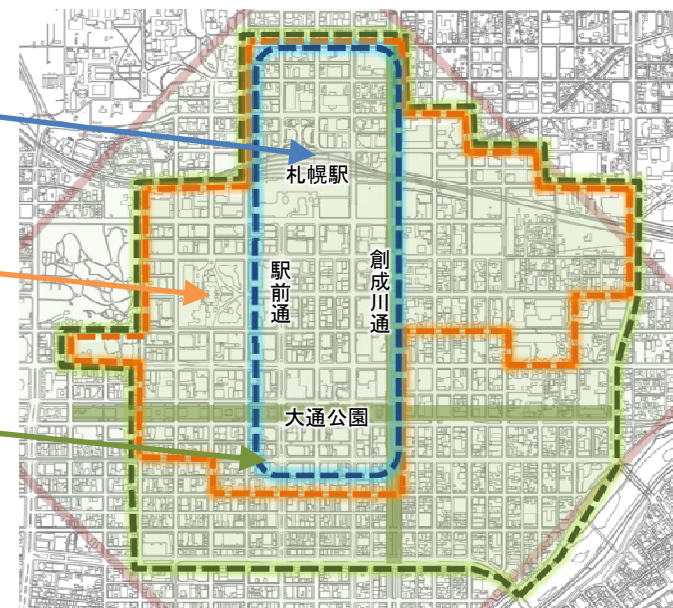


Goal based on the Area

DHC existed area (90ha) how to increase connections

New network area (190ha) network will be planned.

Low carbon area (300ha) reduction of energy use



【Goal for 2050】

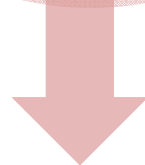
Most of the buildings will be reconstructed up to 2050.

Low carbon

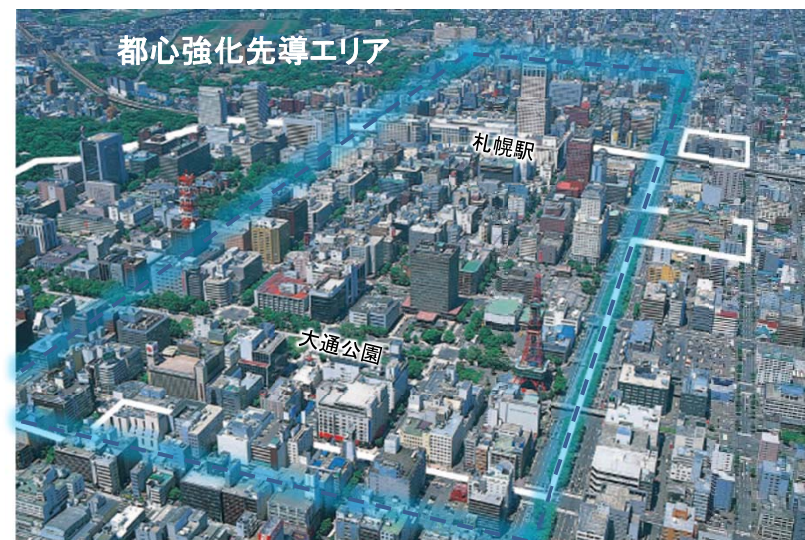


80% reduction of CO2

BCD



Buildings will be connected to the network.



Produce and consume in
the city

Interaction of people

Sapporo

the city

Downtown
Sapporo

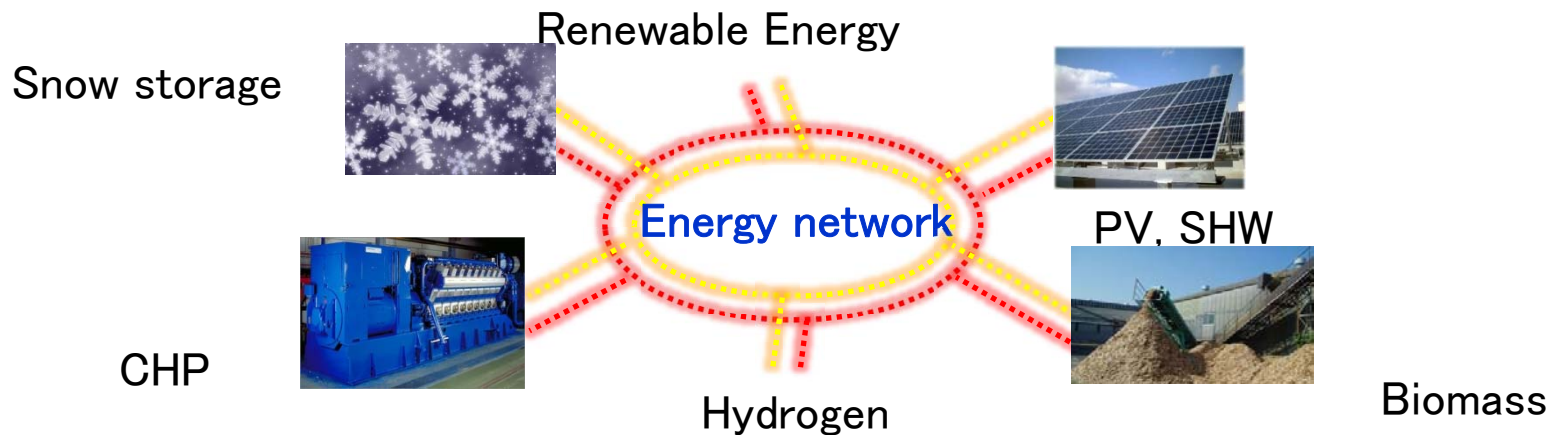
Nice environment to
the next generation

New technology to the
city

Low cost and BCD

Energy resources

Sustainable city



- ✓ **National Level: DHC network should be included as an infrastructure.**
- ✓ **Local Level:**
 - New planning tool, such as obligation of the connection, or tax reduction should be considered.
 - Cross relationship between sections in the municipalities should be developed.
 - How can we reduce the cost? Construction method or pipes?
Hope to work with professionals here!