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4DH

Current Status and Issues of Renewable Heating System towards 4DH in Japan

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Institute for Sustainable Energy Policies

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Outline

4DH

- Current Status of Heat Supply by DH in Japan
- Comparison of DH indexes in EU and Japan
- Possibilities of renewable sources for DH in Japan
- Cases of DH using renewable in Japan
- Concluding Remarks

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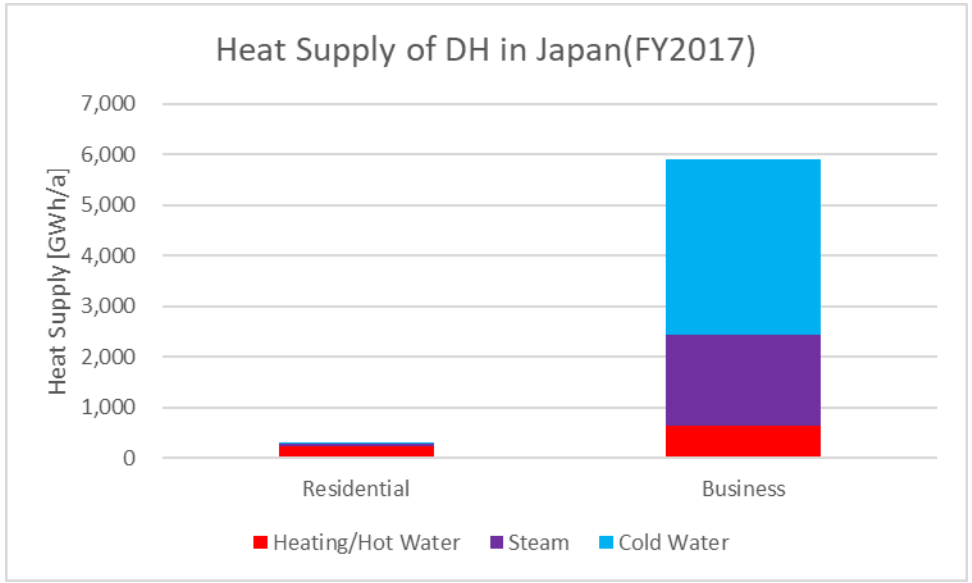
Market of District Heating and other energy business in Japan

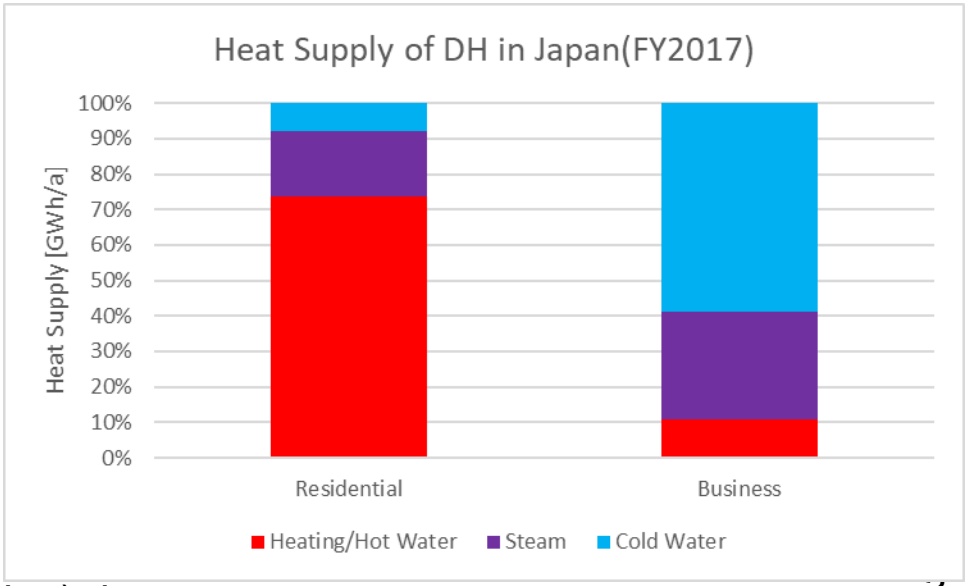
- DH market is very small in comparison with gas and electricity in heating sector
- This is because;
  - ✓ historically, there has been absence of “heat policy” in Japan,
  - ✓ DH has been less importance in Japan’s energy policy,
  - ✓ as a result, oil, gas and electricity industry has been dominant in Japan’s heat market, and compete each other, which resulted in excluding renewable heat historically.

	Electricity Market	City Gas Market	LP Gas Market	District Heat Market
Share of Supply Area	100%	6%	94%	0.01%
Number of consumers	84 million	29 million	24 million	36,000
Size of market	18 Trillion JPY	5 Trillion JPY		0.14 Trillion JPY
Total No. of Employee	130,000	32,400		2500
Total Length of grid		259,000 km	None	646 km
Liberalization of Retail	FY2016	FY2017	Liberalized	FY2016
Notes	10 Big Utilities Over 600 retail company	About 200 retail companies	About 21,000 retail companies	76 Companies, 134 Regions (As of 2017)

Heat Supply by DH in Japan as of 2017

	Unit	Heating/ Hot Water	Steam	Cold Water	Total	Share
Sales(Residential)	GWh/a	233	58	25	316	5.1%
Sales(Business)	GWh/a	645	1,792	3,470	5,907	94.9%
Sales(Total)	GWh/a	878	1,850	3,495	6,224	100%
Share of Sales	%	14.1%	29.7%	56.2%	100%	
Trench Length	km	232	206	208	646	
Linear heat density	MWh/m	3.8	9.0	16.8	9.6	

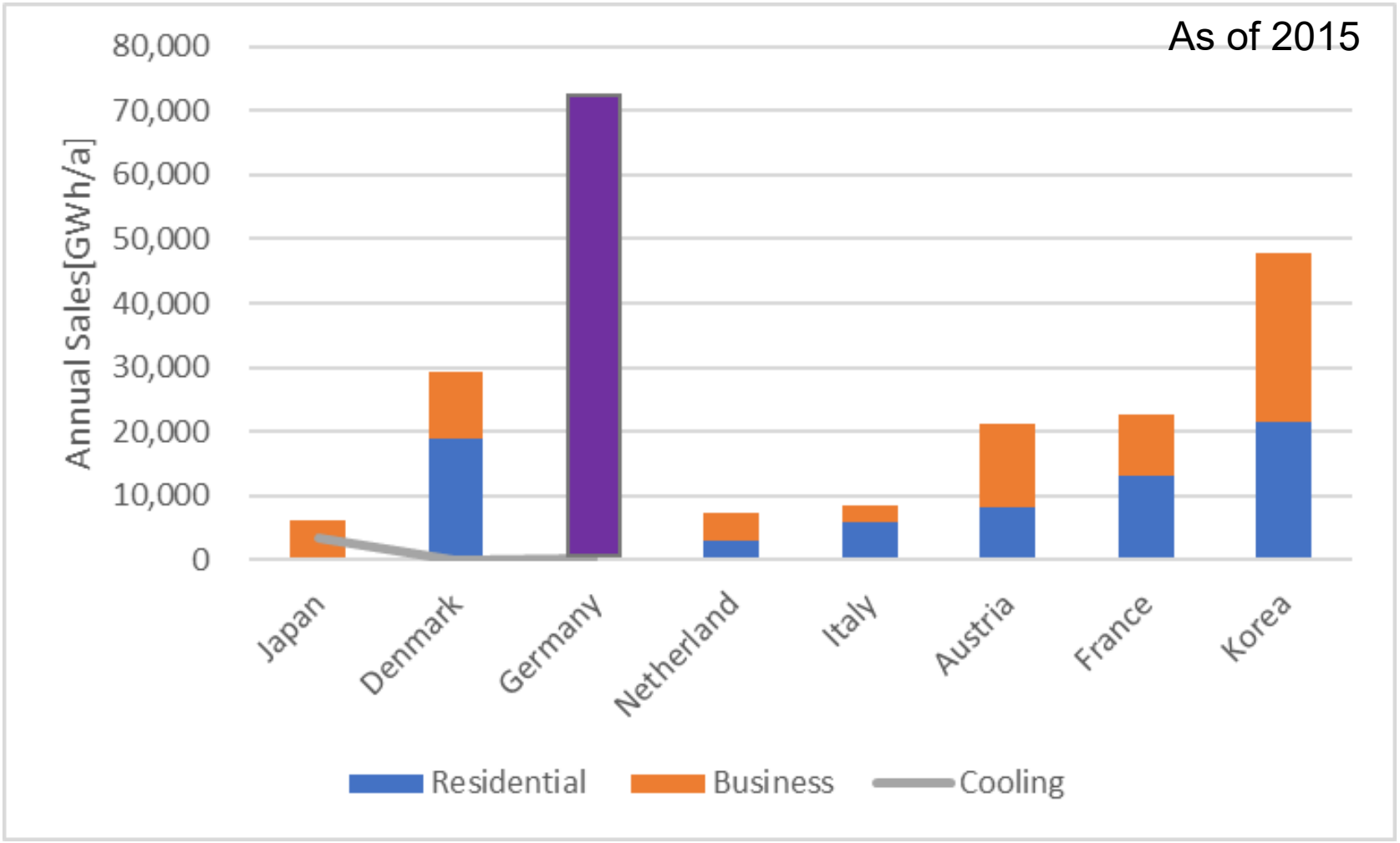




Source: JHSBA(Japan Heat Supply Business Association) data

Share of residential users of DH compared with EU and Japan

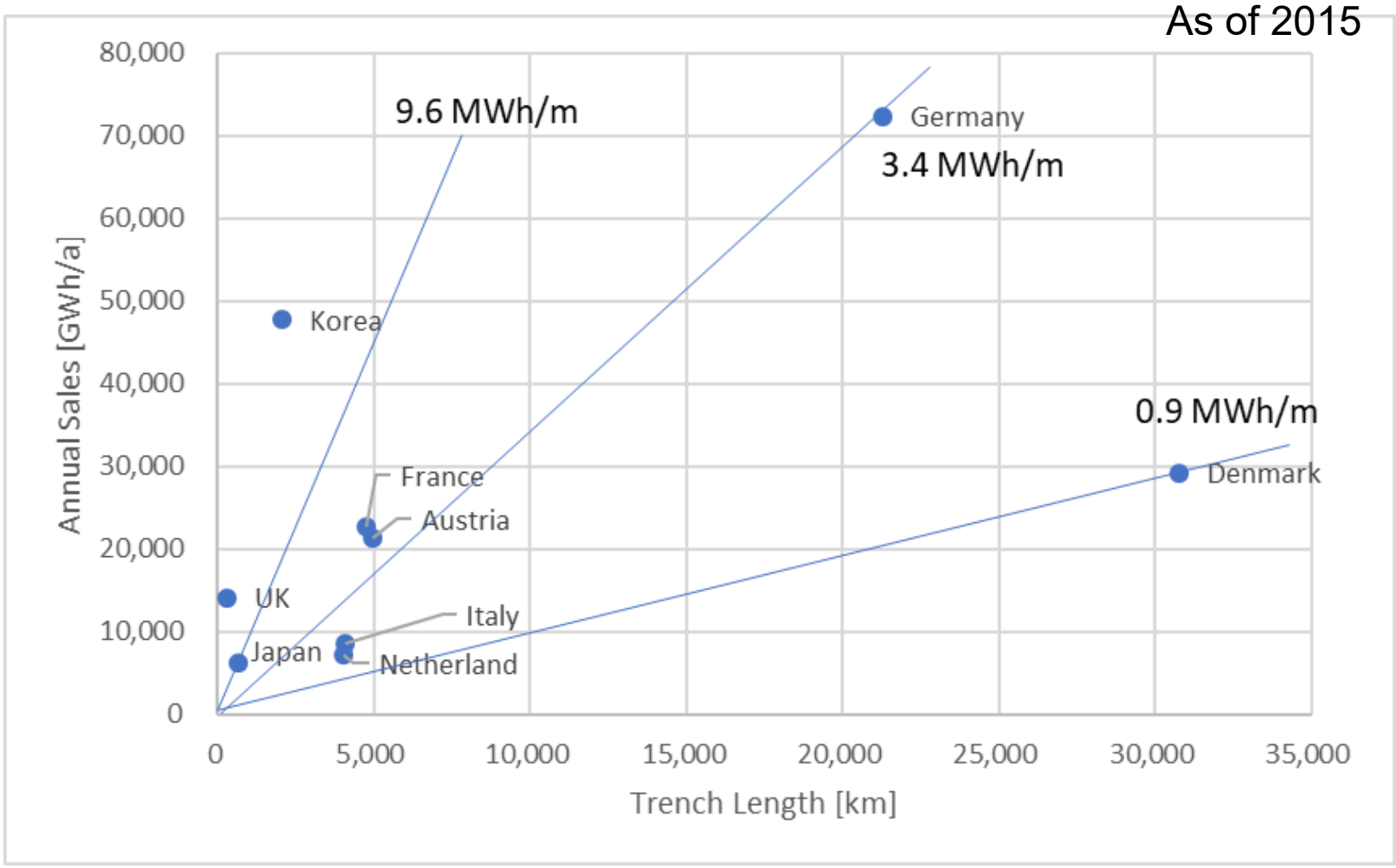
- Share of residential users of DH is very low(5%) in Japan
- Share of cooling of DH is very high (56%) in Japan



Source: Data from EuroHeat & Power Country by Country 2017

Comparison of DH system in EU and Japan

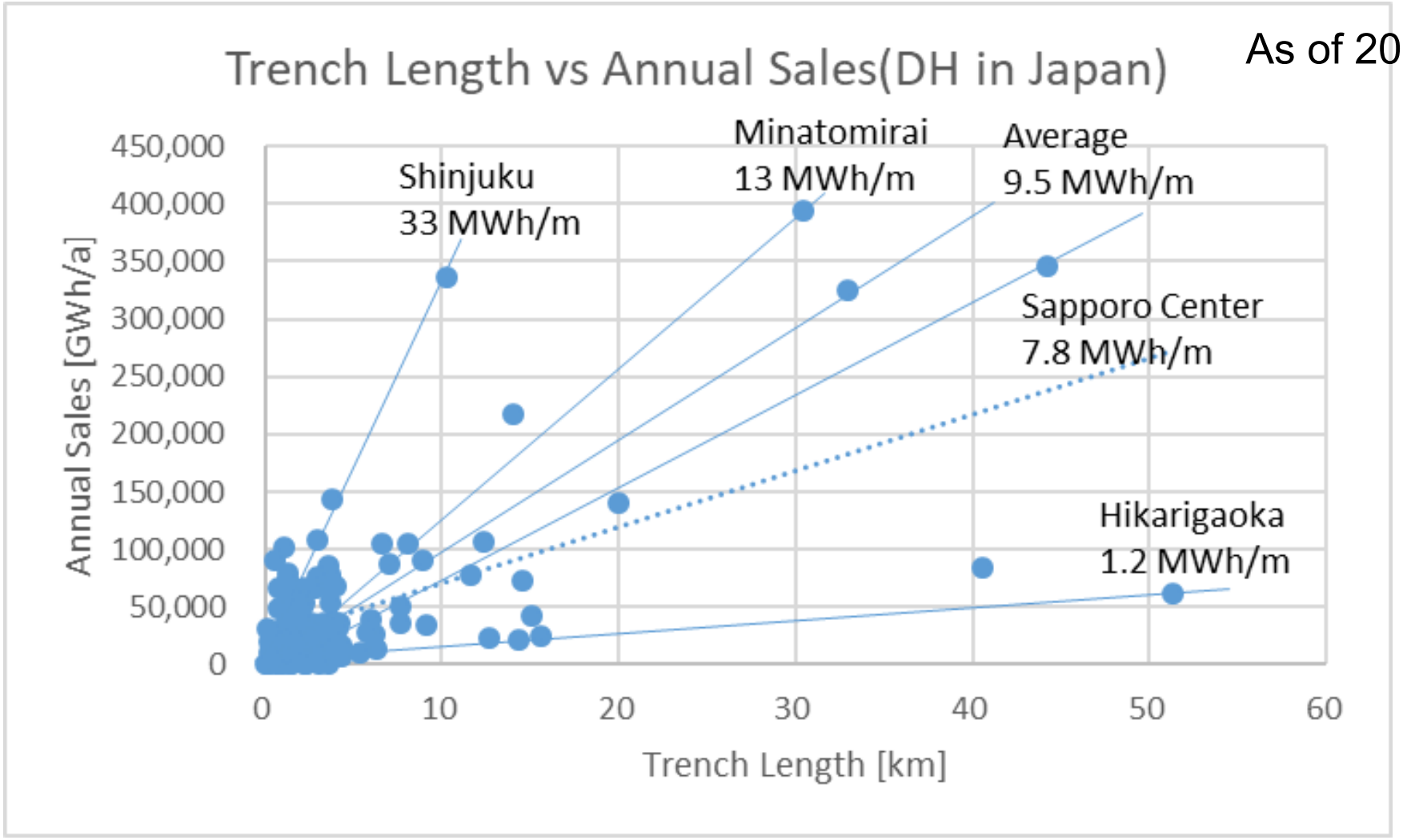
- Linear Heat Density of DH: Denmark: 0.9MWh/m, Japan:9.6MWh



Source: Data from EuroHeat & Power Country by Country 2017

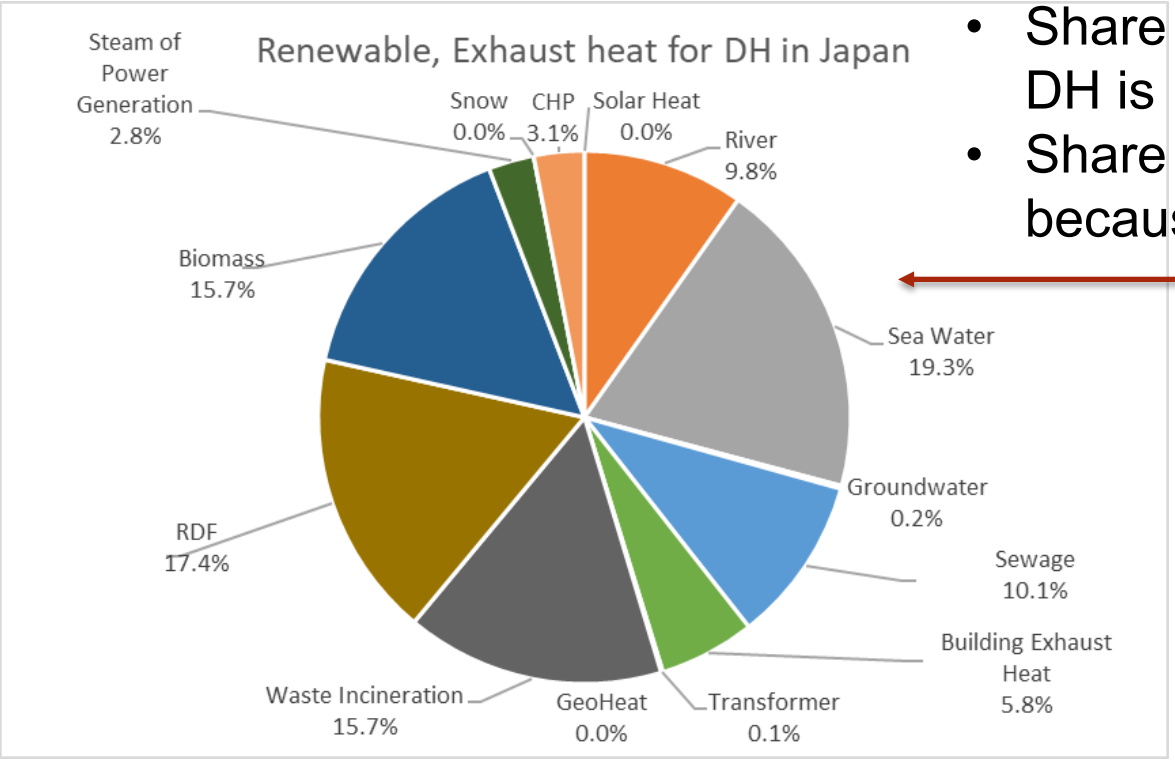
Linear heat density of DH system in Japan

- Average of Linear Heat Density of DH in Japan: 9.5 MWh/m



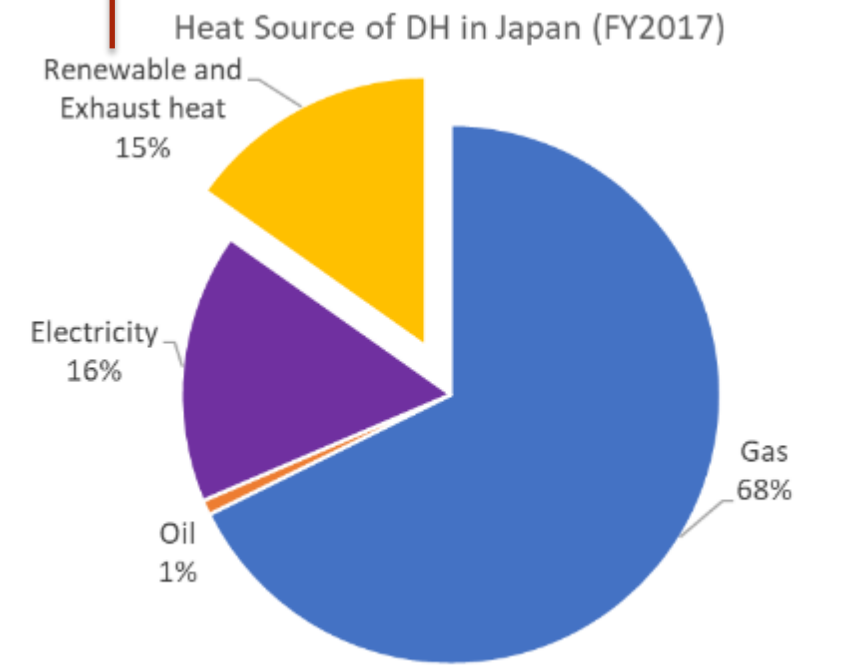
Source: JHSBA(Japan Heat Supply Business Association) data

Heat Source of DH in Japan



- Share of renewable and exhaust heat for DH is 15% in Japan
- Share of electricity for DH is 16% in Japan because of high share of cooling.

As of 2017



- Sea Water: 19.3%
- RDF(Waste): 17.4%
- Waste Incineration: 15.7%
- Woody Biomass: 15.7%
- Sewage: 10.1%
- River: 9.8%

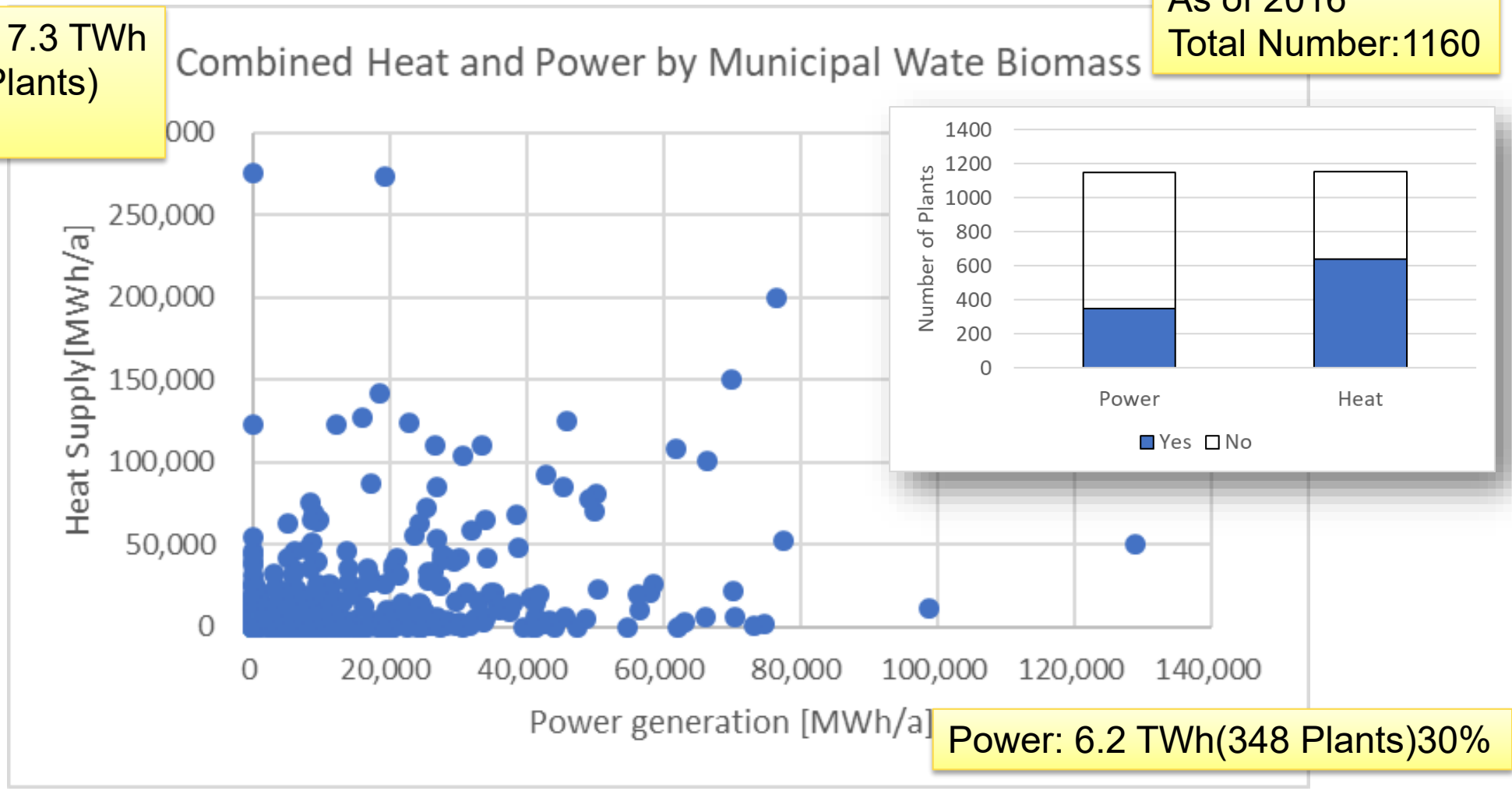
Source: JHSBA(Japan Heat Supply Business Association) data

Heat of Municipal Waste Incineration plants in Japan

- Heat of municipal waste incineration plants are utilized mainly for internal facilities and hot water such as spa and swimming pool.

Heat: 7.3 TWh
(637Plants)
55%

As of 2016
Total Number:1160



Power: 6.2 TWh(348 Plants)30%

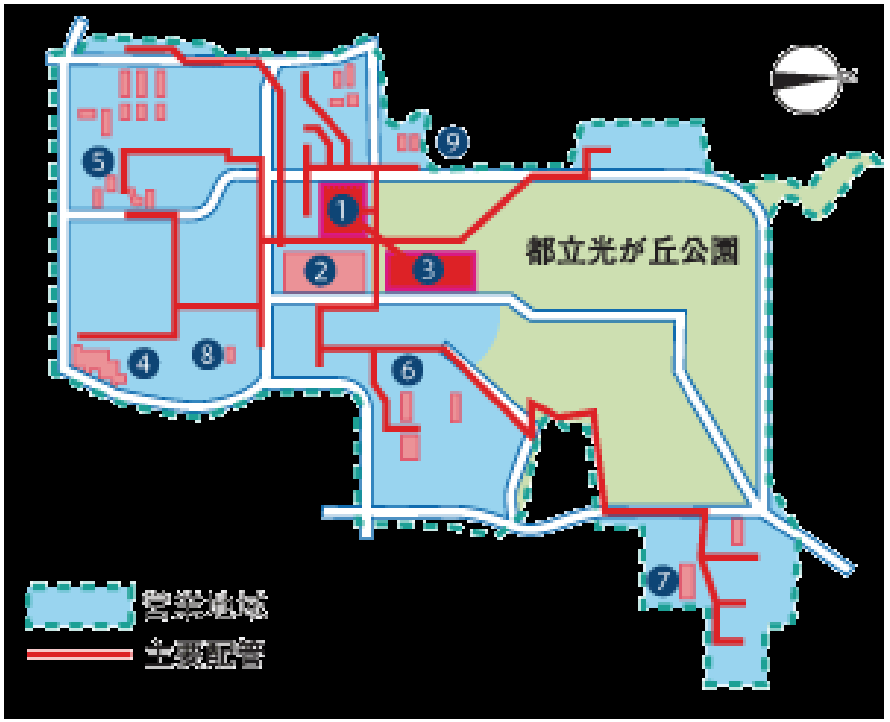
Source: Data of Ministry of Environment

Case of DH: Tokyo Hikarigaoka housing complex Municipal Waste Incineration Heat

- The largest DH system for residential users(12,000) in Japan
- Linear heat density: 1.2 GWh/m/a(61TWh/a, 51km)
- Exhaust heat from Municipal waste incineration: 55℃
- Supply Heat Temperature: 60℃(Residential),45℃(Commercial)
- Supply Cold Water: 7℃(Commercial)

Since: 1983, Total floor area: 1km^2

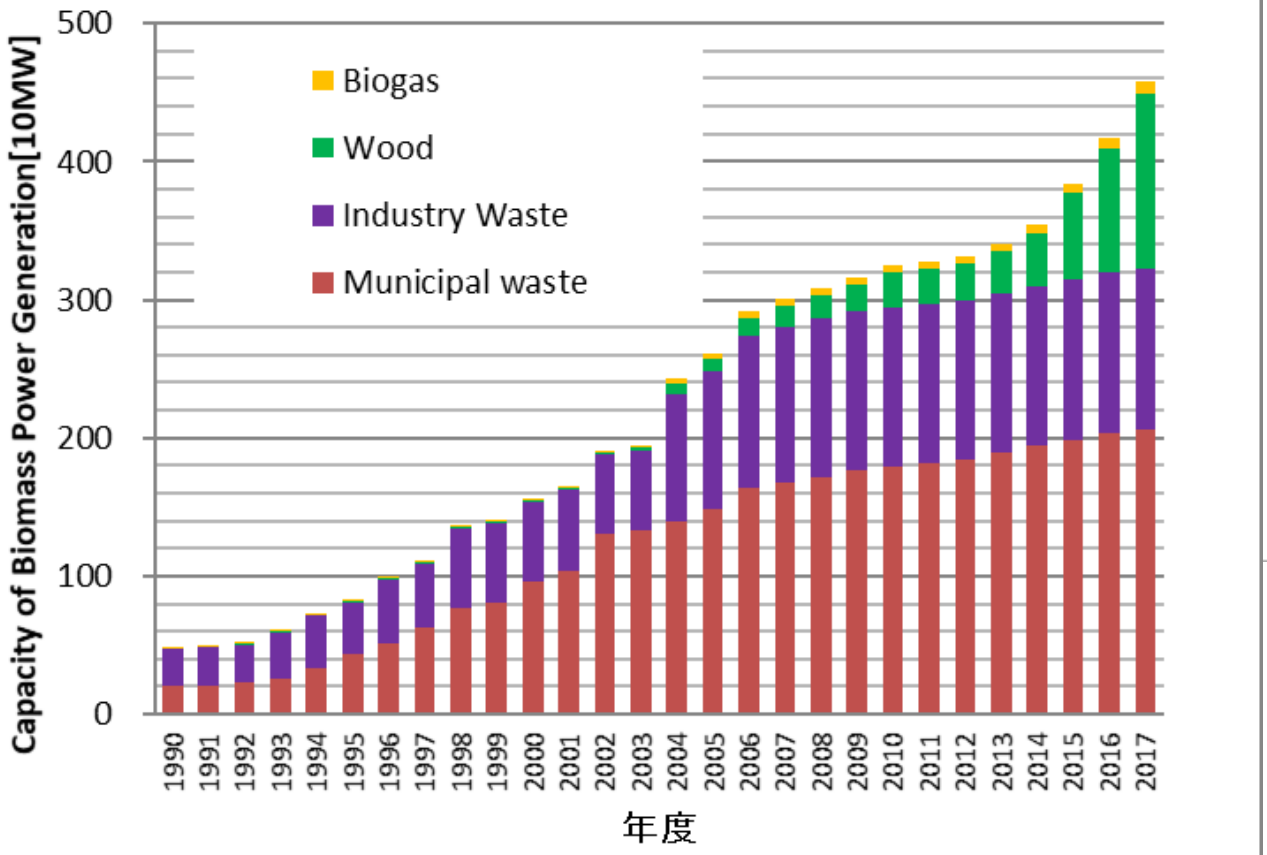
① DH Plant ② Commercial Area ③ Waste Plant
④ - ⑨ School



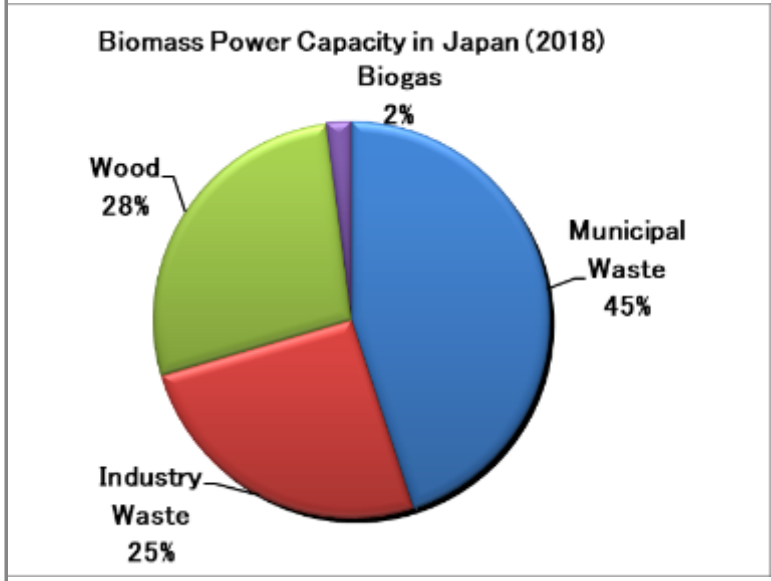
Source: JHSBA http://www.jdhc.or.jp

Biomass Power in Japan

- Capacity of biomass power is increasing because of FIT scheme mainly for woody biomass since 2012. However, FIT scheme promotes power generation only in Japan.



Source: Renewables 2017 Japan Status Report(ISEP)



As of March, 2018

- Municipal Waste: 45%
- Wood: 28%
- Industry Waste: 25%
- Biogas: 2%

Woody Bioenergy in Japan

- More than half of wood chip (8.7 M dry ton) was utilized for power generation only.

Biomass	Unit	Heat only	Heat and Power	Power only	合計
Wood Chip	k dry ton	1,150	3,090	4,490	8,730
Wood Pellet	k ton	40	140	190	380
Firewood	k ton	50	20	-	60
Sawdust	k ton	150	160	100	410
Others	k ton	370	260	320	960

As of 2017

Utilization	Unit	Thinned wood, remaining forest land	Remaining lumber	Waste	Import	Pruned branch
Heat only	k dry ton	110	48	55	0.6	0.4
Heat and Power	k dry ton	410	63	180	13	11
Power only	k dry ton	2,120	39	177	-	21
Total	k dry ton	2,630	150	413	14	33

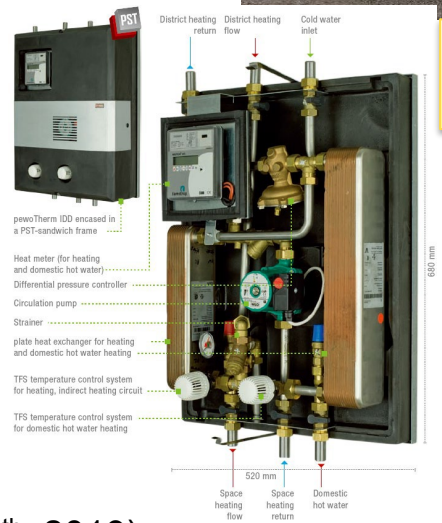
Source：Forestry Agency(2018)
www.maff.go.jp/j/tokei/kouhyou/mokusitu_biomass/index.html

Case of DH in Japan: Mogami town
Small scale DH system in northern rural area

- 23 residential users. Annual heat demand is 183 MWh
- Linear heat density: 0.9 MWh/m
- Heat source is boiler of wood biomass

Biomass Boiler:
90kW × 2
50kW × 1

Trench Length:
0.2km



Source: Shuichi Miura, 4DH symposium(Tokyo, Mar. 14th, 2019)

Concluding Remarks

- Regulatory issues that inhibit promotion of district heating, lack of public interest, relative burial due to competition between electricity, gas and oil.
- Linear heat density is relatively higher than EU countries. Some of DH systems use 3rd generation technologies already for exhaust heat from waste or biomass.
- Heat utilization technologies usually stagnating in the first and second generations of DH using steam from gas. However, electricity is used for low temperature heat supply and cooling already.
- Design guidelines and performance standards should be adopted for increasing renewable heat sources because of unoptimized piping design, low temperature difference, poor heat equipment such as heat exchangers, panel heaters and meters.

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Thank you !

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