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A Study on Local Energy Planning for Hachinohe City

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1.Introduction

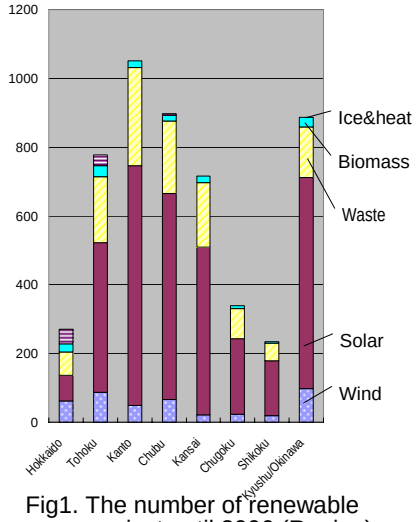

Fig1. The number of renewable energy project until 2006 (Region)

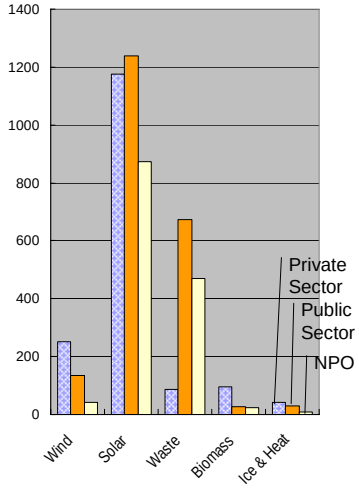

Fig2. The number of renewable energy project until 2006 (Sector)

(The number of photovoltaic power generation for the ordinary family is excluded.)
Sources: Central Research Institute of Electric Power Industry, Governmental statistics concerning on subsidy program

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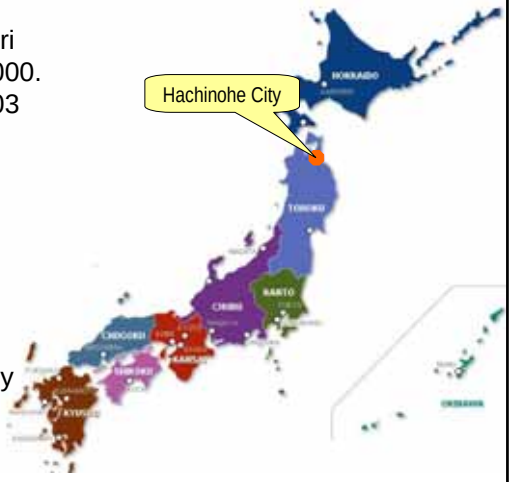
2.Hachinohe City

■ City's guidance

- Largest industrial city of Aomori Prefecture, population is 240,000.
- Enter in the energy field in 2003 and start "Microgrid Project"

■ Project motivation

- Aomori's aim for conversing "nuclear base" image.
- Hachinohe's aim for local economy revitalization.
- R&D project subsidized entirely by the National Government.



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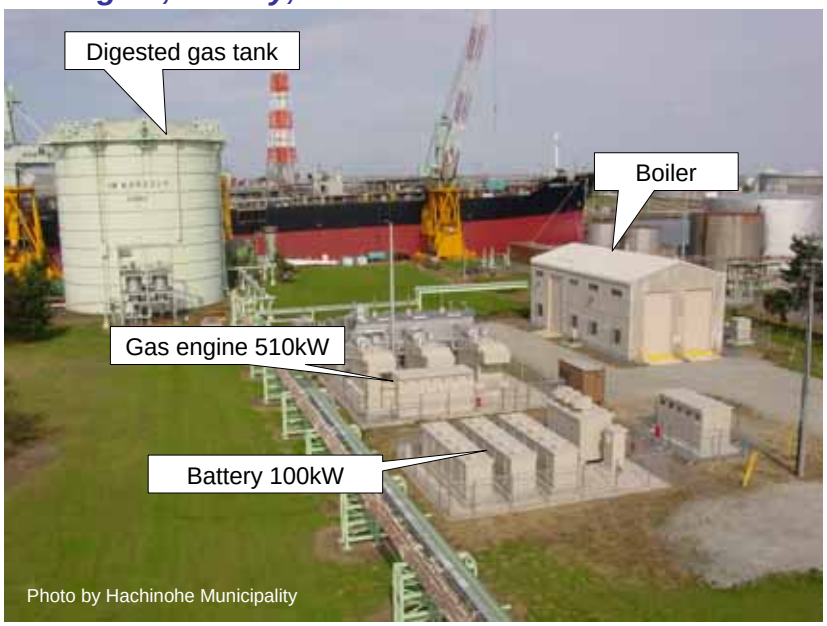
Hachinohe energy center
Gas engine, battery, biomass boiler



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Wind power generation 8kW
Public elementary school

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Photovoltaic generation 10kW
Public junior high school

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Photovoltaic 10kW, Wind power generation 4kW
Hachinohe City Hall

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Hachinohe City
Energy Vision and Target

■ New energy vision (2004)
- Raise the rate of renewable energy use in the final energy consumption to 6% in 2010.

■ Energy conservation vision (2005)
- Reduce energy consumption by 12.6% from the reference case in 2010.

■ City master plan (2006)
- Raise the rate of renewable energy use in the final energy consumption to 6% in 2010, at least 4.5%.
- Reduce energy consumption by 5.6% in 2010 from 2005.

➢ *It is worth doing the research whether these motivated targets are reliable or not.*

(New energy Vision, 2004)

(Energy conservation Vision, 2005)

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3.Practice of local energy planning

■ Objectives
- Make city's future energy demand and supply plan,
- Analyze the result of reference case,
- Reflect city's existing target to the model, and
- Propose appropriate policy to the local government.

■ MARKAL model
- An bottom-up engineering model using linear programming,
- Achieved by the international cooperation under ETSAP/IEA,
- Objective function is cost minimizing under various constraints,
- Suitable for renewable energy introduction analysis.
- Japanese MARKAL has been maintained by Japan Atomic Energy Agency, it covers all demand sectors, 260 energy technology and 40 energy carriers in the period of 1990-2050.

➢ *We try to make regional MARKAL model (Hachinohe MARKAL) using the basic concept of Japanese MARKAL.*

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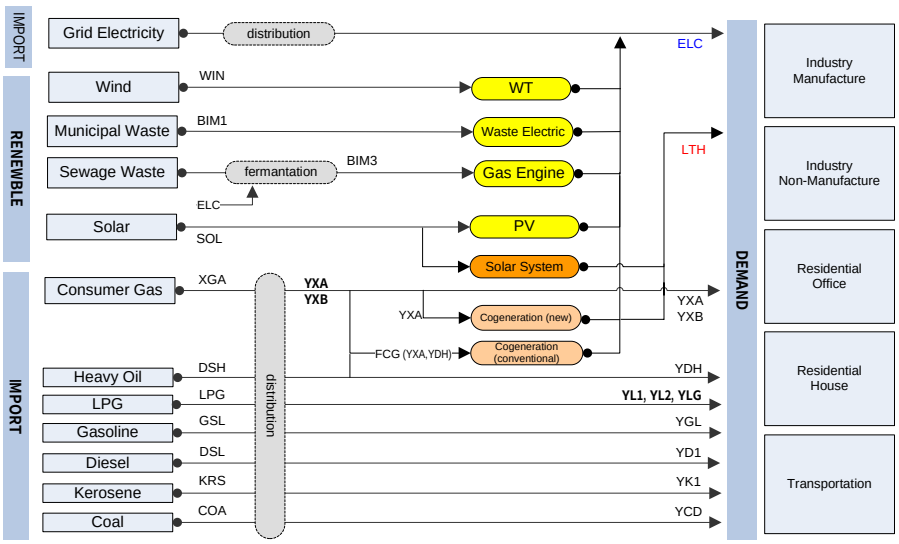
(1) Hachinohe MARKAL reference case
Input factor of the system

Item	Input data	References
Period, Time slice	2000-2030, seven 5-year period, 6 time slices of ID:0.2106 SD:0.1009 WD:0.1885 IN:0.1961 SN:0.0135 WN:0.2904	The number of heating/ cooling day of city office and daylight hours in 2005.
Demand side discount rate (2010/2000, 2030/2010)	I1:Industry manufacture: 0.0127, 0 I2:Industry non-manufacture: -0.0022, 0 R1:Residential office: 0.0204, 0.0036 R2:Residential house: 0.0066, 0.0032 T1:Transport car&bus: 0.0190, 0.0015.	New energy vision, Japan Long-Term Energy Outlook 2030, and other various sources
Supply side	Source(13), Energy carrier(25), Process technology(13), Conversion tech.(7), Demand tech.(25=dummy)	Japanese MARKAL JAEA database
Unit	TJ, GW, kt-CO2/TJ, Mil JPY	Japanese MARKAL (1/1000)
Fuel price (2030/2005)	Oil and oil related fuels =1.27 Electricity (production cost) =0.94	Various sources
Emission	CO2 emission of each fuel is counted at the time of import.	Ministry of the Environment, Japanese MARKAL, Tohoku Electric Power Company

(1) Hachinohe MARKAL reference case
Energy flow of the system



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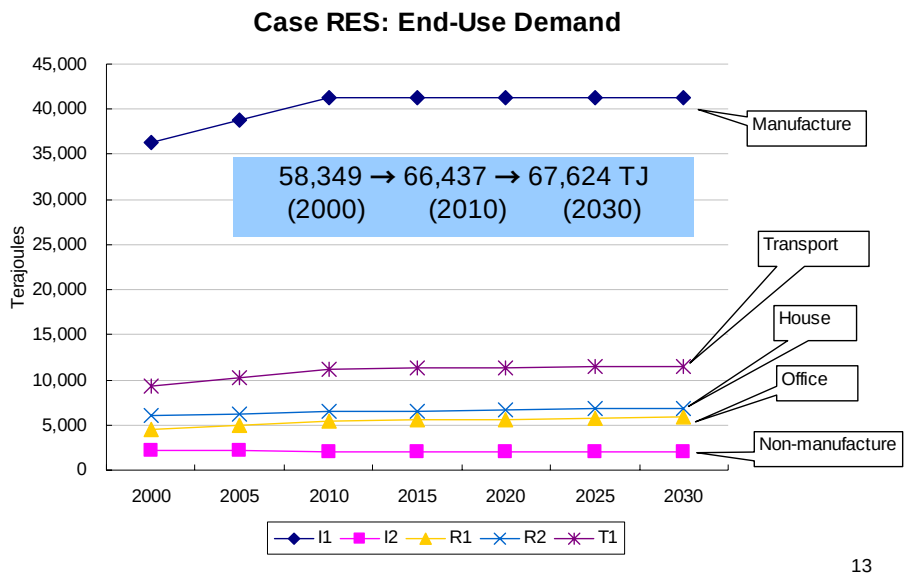
(1) Result of Hachinohe MARKAL reference case



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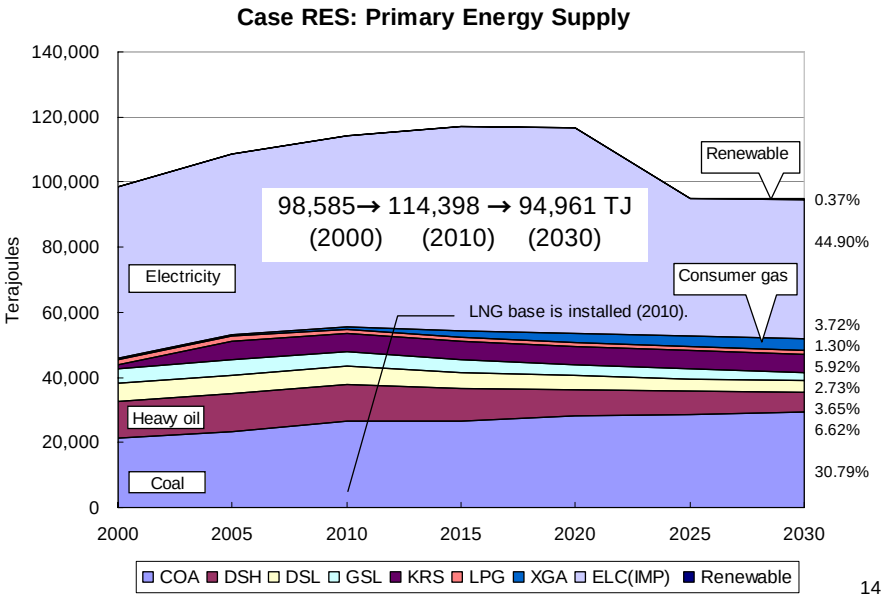
(1) Result of Hachinohe MARKAL reference case



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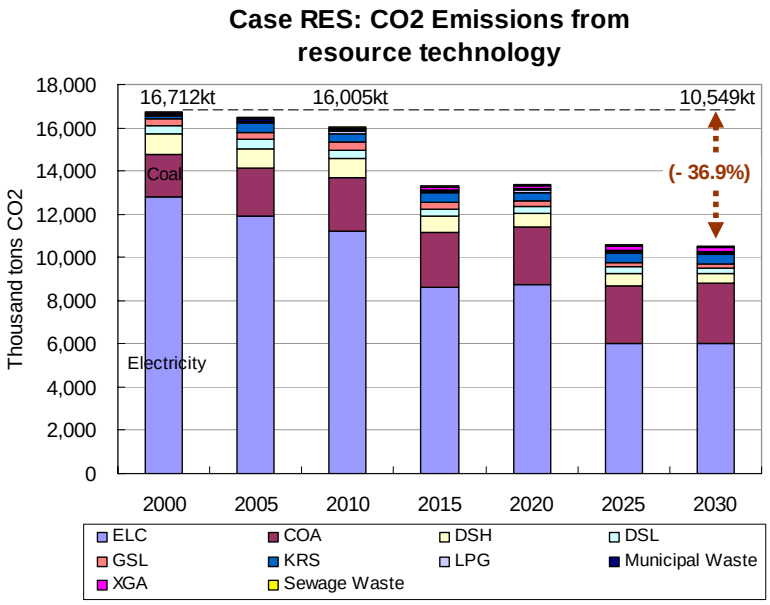
(1) Result of Hachinohe MARKAL reference case



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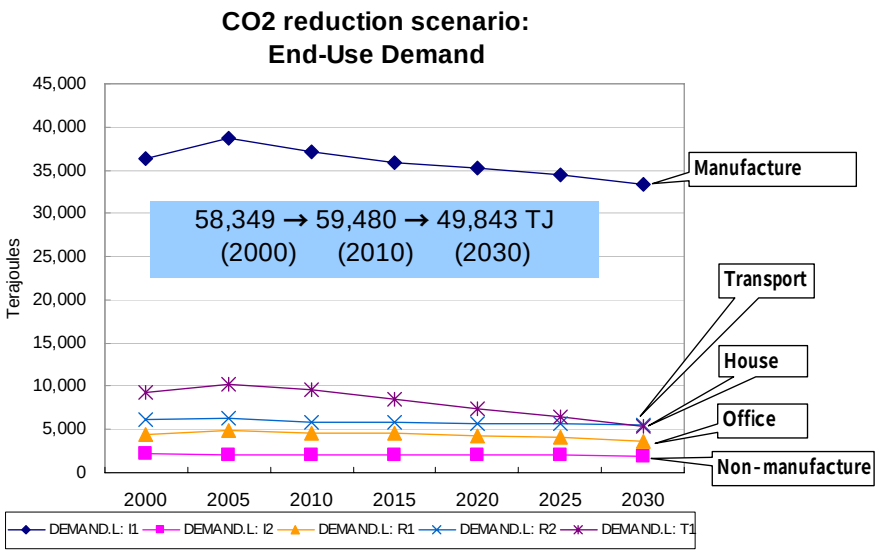
(2) Hachinohe MARKAL alternative scenario Input factor of CO2 reduction case

Item	Input factor	References
(1) Energy demand reduction	2005→2010 All sectors minus 5.6%	City master plan
	2000→2030 Industry minus 8.8%, Residential minus 25.8%, Transport minus 42.0%	Triple 50 target (Tokyo University and others)
(2) Renewable energy introduction	2000→2010 Rate of renewable energy use in the final energy consumption to 6%.	New energy plan City master plan
	Extra technology: -Wind Power, plus 2MW -Solar PV, plus 3MW -Waste Electric, plus 3MW -Other Waste power (private company), plus 18MW -Solar Heat, plus 300 TJ	New energy plan, Committee report on Hachinohe offshore wind, and other sources..

(2) Result of Hachinohe MARKAL alternative scenario



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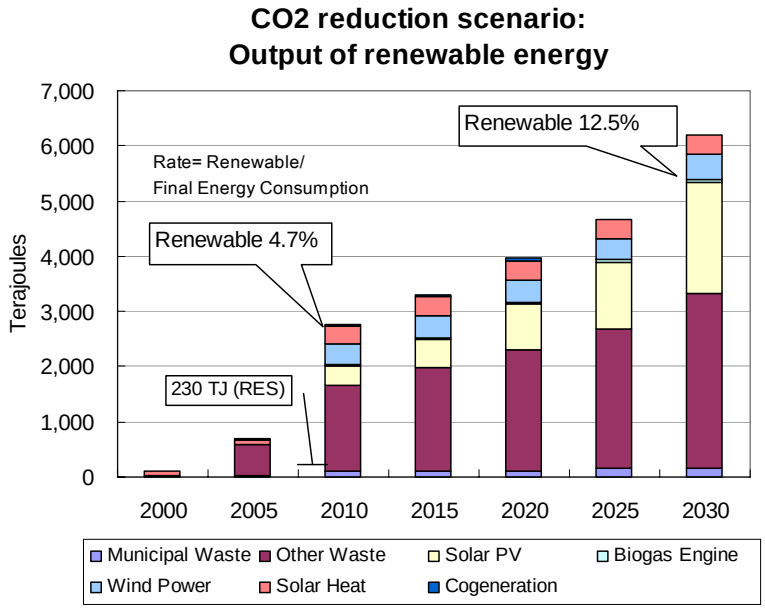

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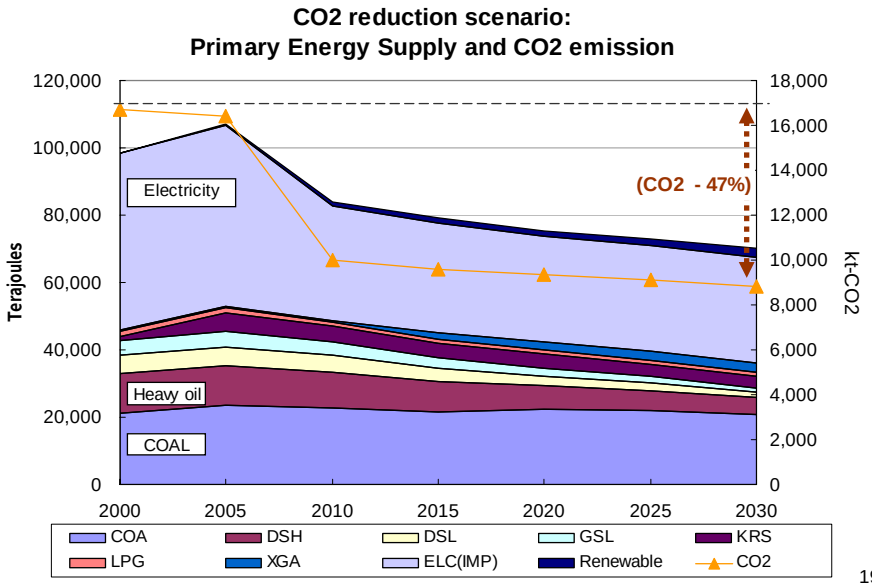
(2) Result of Hachinohe MARKAL alternative scenario



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4.Conclusion

■ For renewable energy implementation

- It is indispensable for local governments to overcome the dissociation between vision and project.

➢ Develop local energy planning which shows a sustainable path to introduce renewable energy.

■ Further research topics

- Improve the regional MARKAL model and sub-modeling tools (updating technical data), and
- Investigate the method for advancement of local energy planning in cooperation with local actors.

➢ In reference with the ALEP methodology (ETSAP/IEA)

1) Assessment of the present situation,
2) Main Study with energy modeling tool (MARKAL),
3) Project Implementation, and
4) Review and Monitoring.

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Thank you for listening.