A Model Analysis of Energy Network in Zero Emission Industrial Park

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Contents *1. Introduction* *2. Modeling*
3. Results *4. Conclusion*

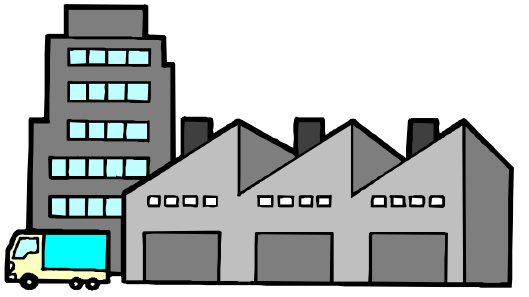
introduction

AIM

*To evaluate the energy saving in case of introducing **CHP** and **energy network** in the real zero emission industrial park.*

TARGET

Kokubo Industrial Park



METHOD

Interview & Simulation

RESULTS

*Energy saving to the demand reaches **22%**.*

2000年（平成12年） 4月14日 金曜日

パイプライン着工

帝国石油 諏訪―昭和間70キロ

都市ガスを安定供給へ

帝国石油（本社東京）は十三日、長野県諏訪市と中巨摩郡昭和町を結ぶ天然ガスのパイプライン「甲府ライン」建設に着手した。延長は約七十キロ。予定ルート周辺の建設業者や市町村と協議しながら工事を進め、二〇〇二年秋の完成、二〇〇三年からの供給を目指している。

天然ガスのパイプライン建設に向けて、関係市町村長らが出席して行われた起工式 ＝北巨摩郡双葉町岩森

社側によると、帝国石油が新潟で産出した天然ガスをパイプラインで輸送し、東京ガス甲府支社が都市ガスとして供給する。帝国石油は新潟と東京を結んでいる「東京ライン」から松本市をつなぐ「松本ライン」を分岐するため、現在工事を進めている「甲府ライン」は「松本ライン」を諏訪市で分岐させて敷設する。

諏訪から分岐したパイプラインは、県内では小淵沢、長坂、高根、須玉、明野、韮崎、双葉、敷島、甲府の市町村を通って昭和町に至るコースを予定。地中約一一・五㍍の地点に管を埋設し、約

City gas supply in Kofu
60,000→200,000[m³/day]

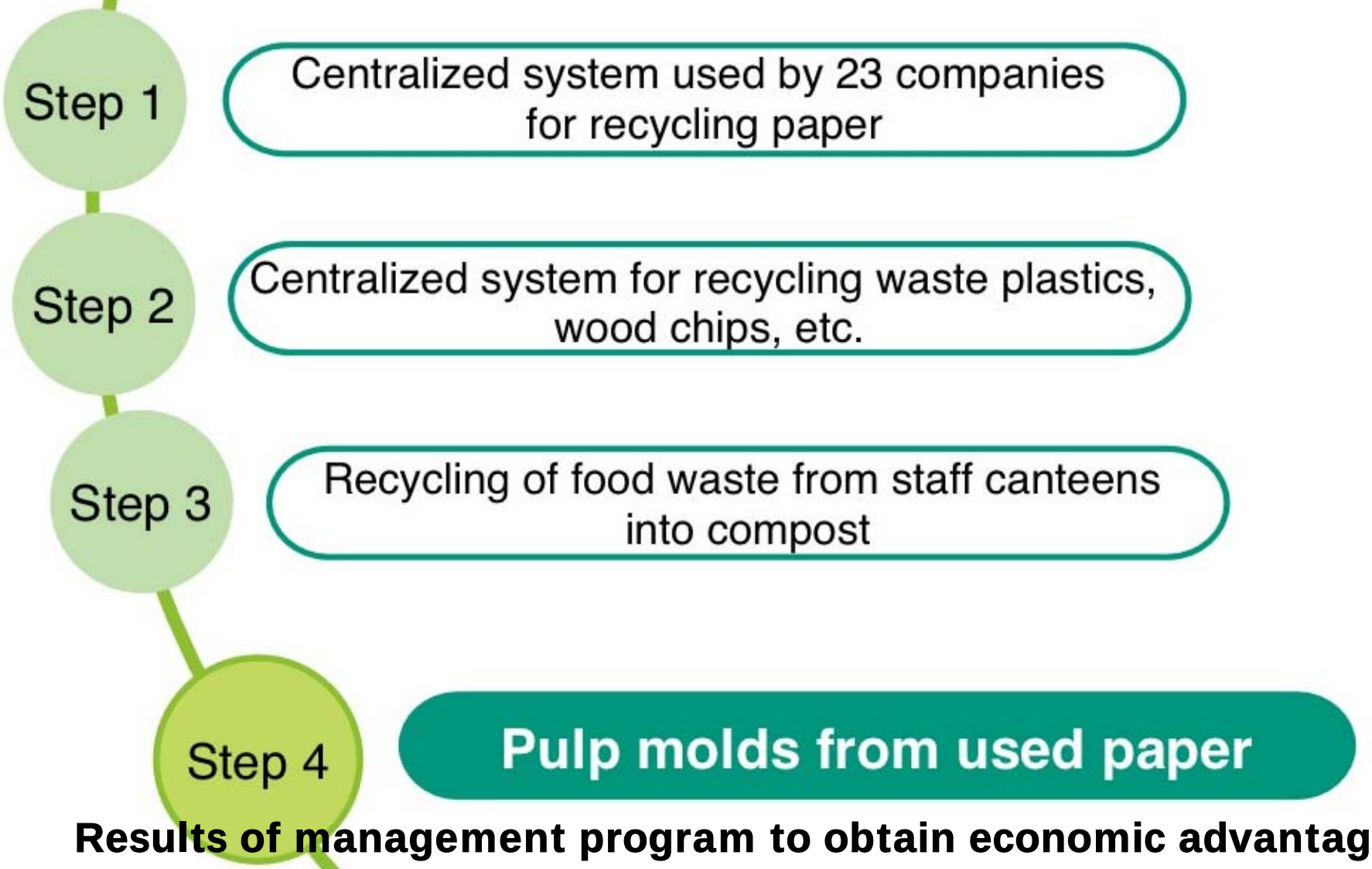
Kokubo industrial park

1. *Located 110 km west of Tokyo.*
2. *Biggest industrial park in Yamanashi.*
3. *956,000 m^2 site housing 24 companies and about 5,500 employees.*

e.g. Yokogawa Electronics, Panasonic, Fujitsu, KONICA and Pioneer etc.

4. *10 companies obtained ISO14001.*
5. *Beginning of zero emissions activity in 1992, consortium has already implemented the fourth step.*

Zero emission activities

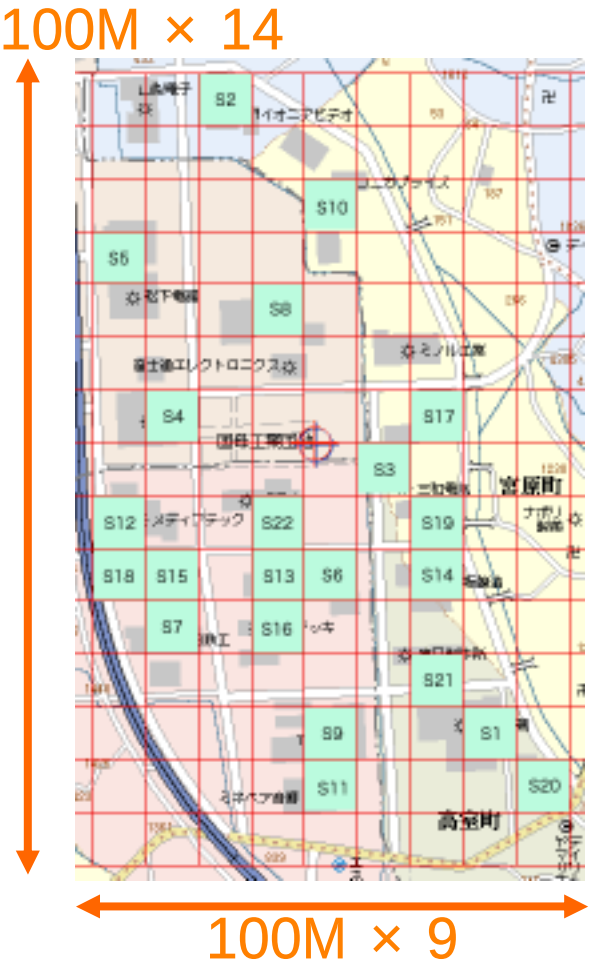


Results of management program to obtain economic advantage while putting into action their concern for the environment.

Local energy network

Steam, hot water, heating, cooling and electric power by interviews.
The industrial park divided into the 10,000 square meter mesh
in order to take steam transport into consideration.

	peak demand [kW]	thermo -electric ratio[-]		peak demand [kW]	thermo -electric ratio[-]
A	2,652	1.9	L	2,691	1.7
B	2,549	2.0	M	243	1.3
C	715	2.2	N	710	3.7
D	2,248	2.6	O	104	5.4
E	1,663	1.9	P	288	0.6
F	58	0.4	Q	433	0.2
G	215	0.1	R	255	0.6
H	5,516	3.2	S	432	11.5
I	1,938	1.4	T	65	0.0
J	2,589	1.3	U	258	1.4
K	752	0.6	V	1,080	0.3



Model formulation

Linear programming techniques

Objective function(total system cost)

J = fuel + plant + consignment + pipeline → Min.

Constraints

energy supply & demand balance
energy storage input & output balance
transport of electric power
transport of steam i.e. pipeline

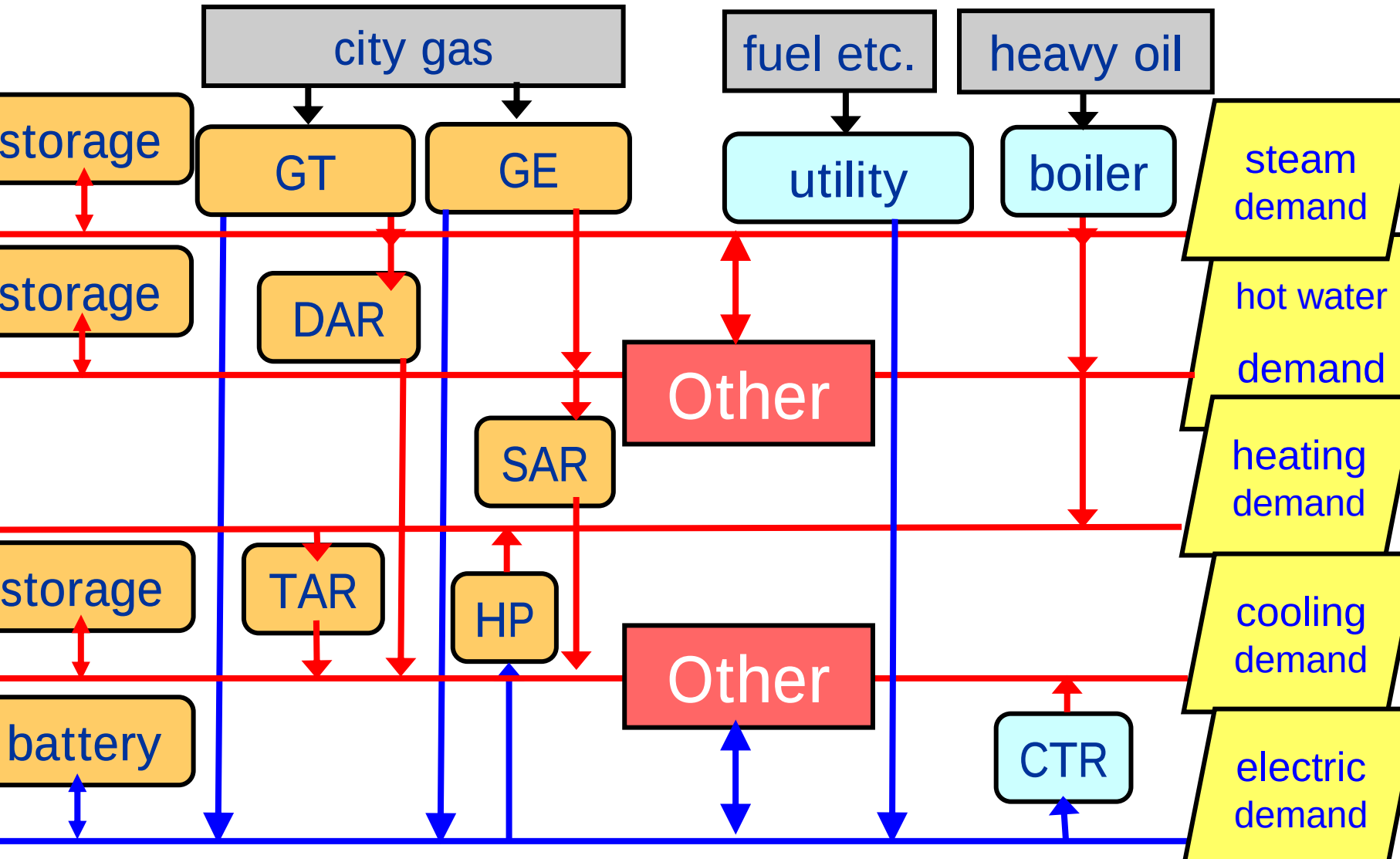
Periods 1 year(3 seasons×24 hours)

without consideration replace.. static model

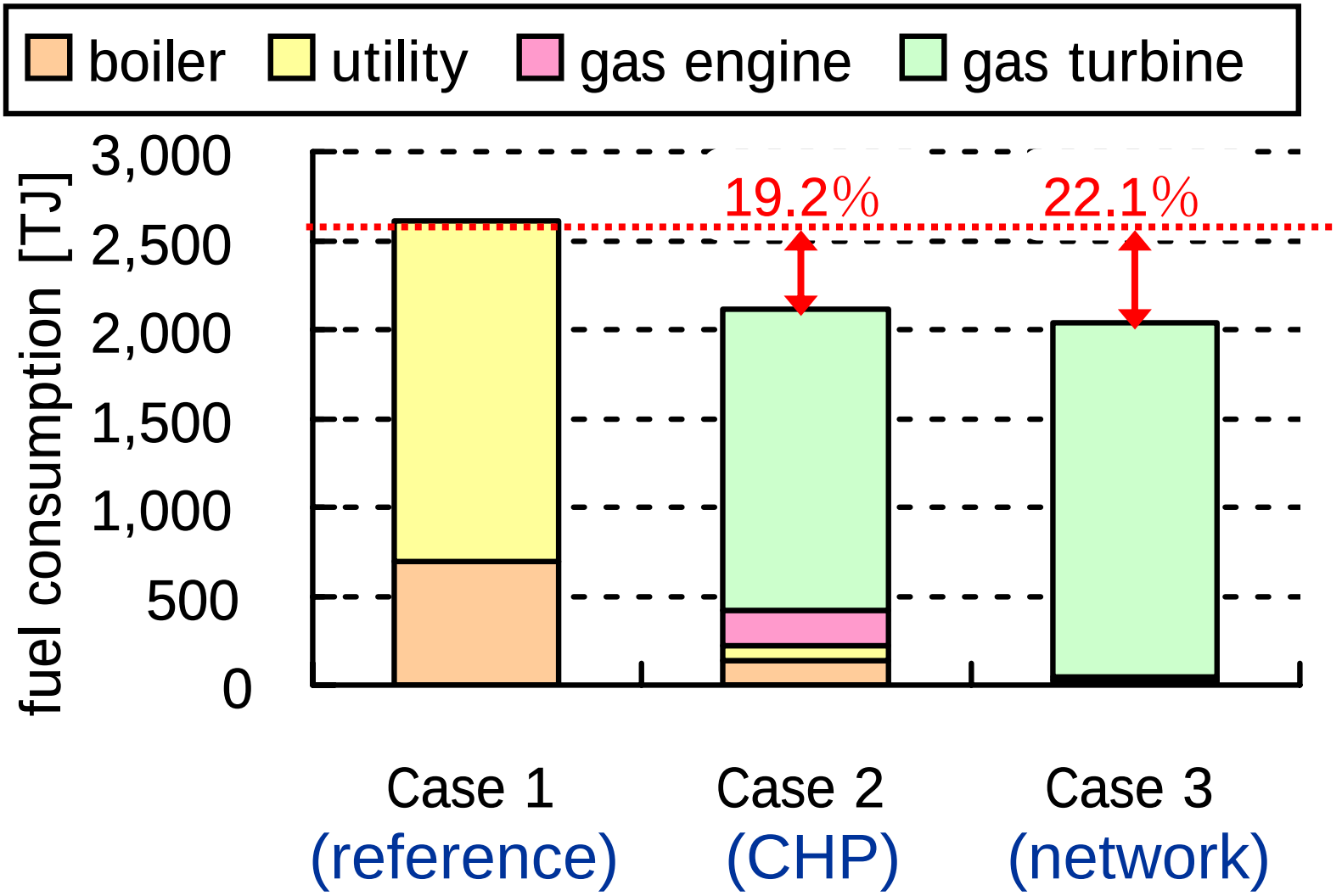
Case1: reference
Case2: +CHP
Case3: +network

Simulation cases

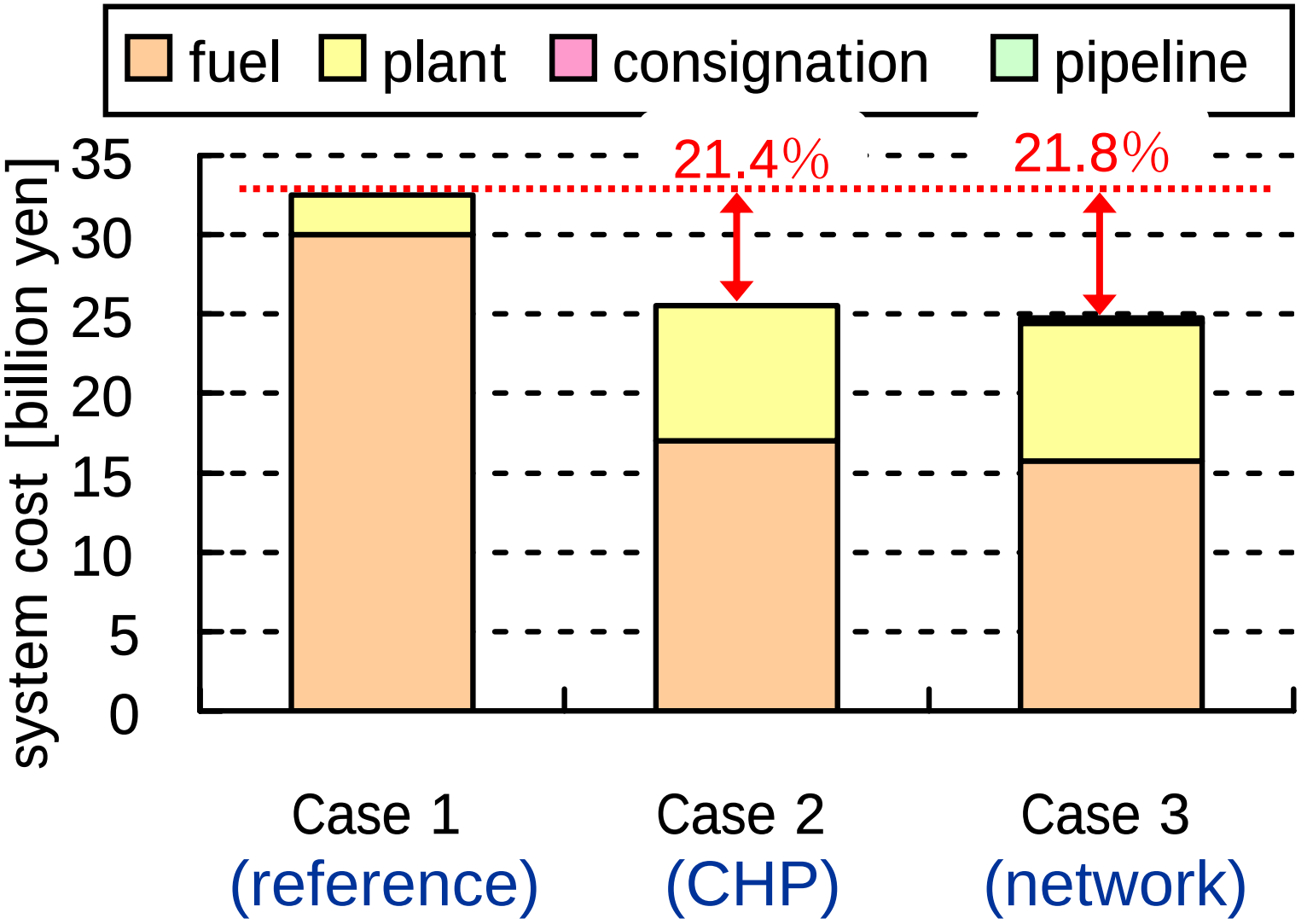
Case 3



Energy saving potential

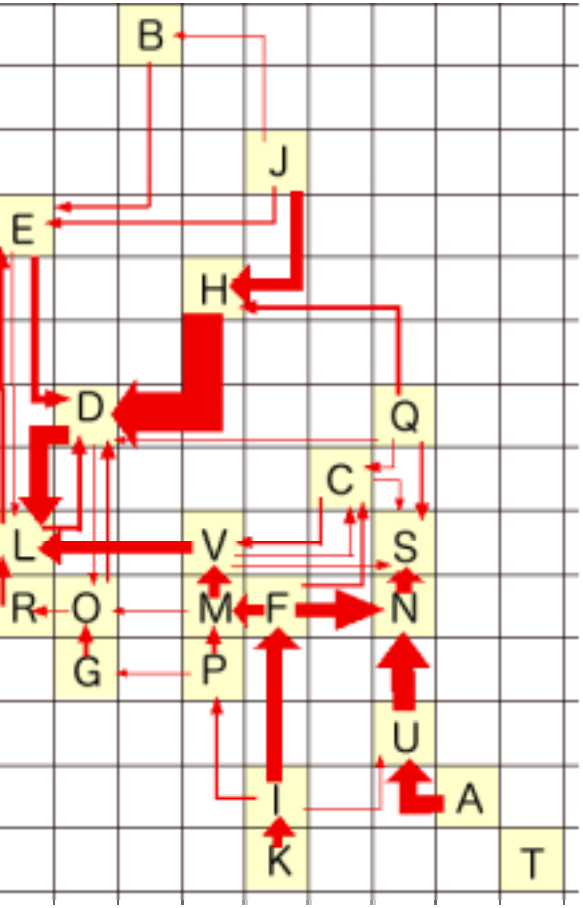


System cost results



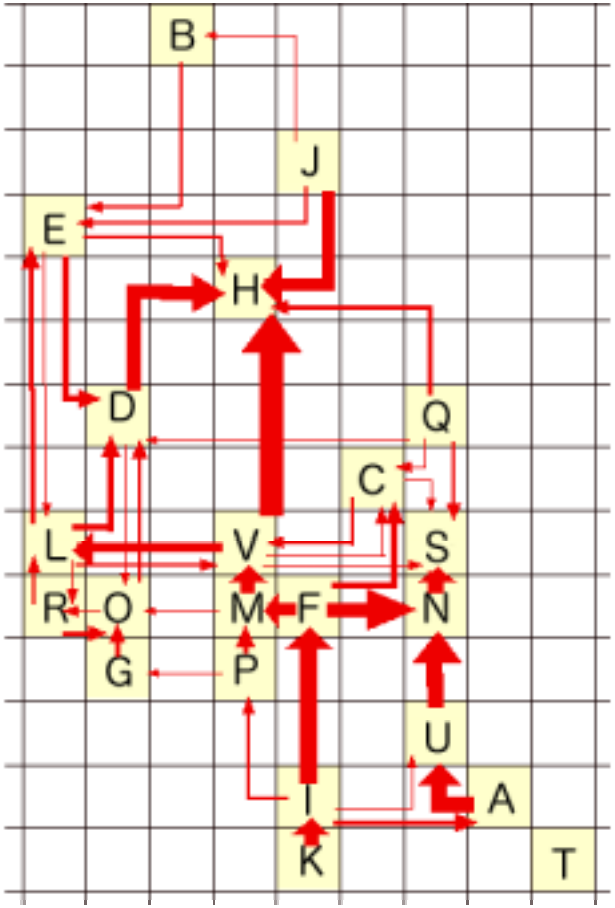
Steam network

Steam network to another factory increases in middle season.



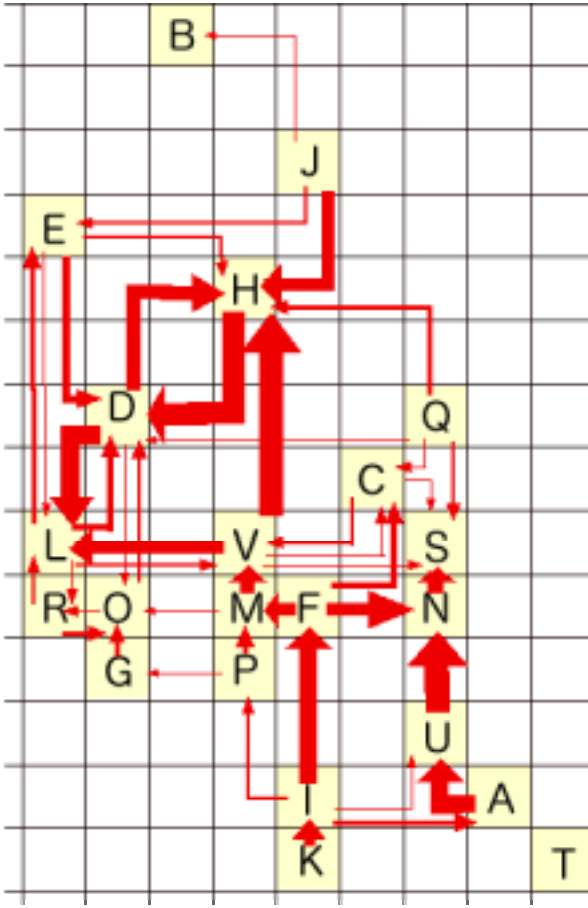
winter

heating ↑



summer

cooling ↑



middle

heating & cooling ↓

Summary

1. *Energy saving reaches 22% compare with reference system. (15,000kL oil equivalent)*
2. *Steam transportation changed with seasonal.*

This is very useful for the role of new energy demand and supply system.

Future Plan

1. *Analyze the location place, the number and the scale of gas turbine in this industrial area.*
2. *Consider the dynamic model using MARKAL*