Modification of ESS
- Energy sector -

AIM Training Workshop

Tsukuba, Japan Oct 27-31, 2008

Background

- Back Cast Model and Energy Snap Shot are cross-linked.
- The structure of ESS (Power sector & Energy sector) was modified to link BCM.
  - "ENE" sheet is created.
- The concept of PWR sheet is not changed.
  - Aggregate 5 sectors' energy consumption into "ENE" sheet.
  - Set transmission losses / own use rate / mixture of energy / thermal efficiency in power sector,
  - Calculate primary energy consumption.
- The structure of new "ENE" sheet became the same as the other sectors.

Contents

Background

- Goal: Primary energy consumed for electricity generation in target year.

Energy sector

1 Energy service demand

	Unit	受電端 2000	受電端 2050 A	受電端 2050 B	Transmission loss 2000	Transmission loss 2050 A	Transmission loss 2050 B	送電端 2000	送電端 2050 A	送電端 2050 B
COL	Mtoe	49	28	23	0%	0%	0%	49	28	23
OIL	Mtoe	225	59	57	0%	0%	0%	225	59	57
GAS	Mtoe	28	34	51	0%	0%	0%	28	34	51
BMS	Mtoe	2	13	16	0%	0%	0%	2	13	16
Heat	Mtoe	0	1	0	0%	0%	0%	0	1	0
H2	Mtoe	0	11	11	0%	0%	0%	0	11	11
ELE	Mtoe	75	63	74	5%	5%	5%	79	66	78

4-6 Energy consumption / CO2 Emission

		Unit	COL	OIL	GAS	BMS	S/W	NUC	HYD	GEO	Total
4 Energy Consumption	2000	Mtoe	85	237	78	2	0	82	6	3	494
	2050 A (CM)		45	60	88	13	0	89	10	2	307
	2050 B (CM)		0	13	14	53	16	0	0	72	168
5 Emission Factor	–	MtC/Mtoe	1.05	0.80	0.55	0.00	0.00	0.00	0.00	0.00	-
6 CO2 Emission	2000	MtC	90	190	43	0	0	0	0	0	322
	2050 A (CM)		31	48	28	0	0	0	0	0	107
	2050 B (CM)		0	10	8	0	0	0	0	0	18
		Unit	COL	OIL	GAS	BMS	Heat	H2	ELE		
7 Emission Factor	2000	MtC/Mtoe	1.05	0.76	0.55	0.00	0.00	0.61	1.12		
	2050 A (CM)		1.05	0.76	0.55	0.00	0.00	0.61	0.12		
	2050 B (CM)		0.00	0.08	0.14	0.42	0.00	0.00	0.00		

2 Service Share

	Unit	2000 COL	OIL	GAS	BMS	S/W	NUC	HYD	GEO	Total	2050 A (CM) COL	OIL	GAS	BMS	S/W	NUC	HYD	GEO	Total	2050 B (CM) COL	OIL	GAS	BMS	S/W	NUC	HYD	GEO	Total
COL	-	100%	0%	0%	0%	0%	0%	0%	0%	100%	100%	0%	0%	0%	0%	0%	0%	0%	100%								100%	100%
OIL	-	0%	100%	0%	0%	0%	0%	0%	0%	100%	0%	100%	0%	0%	0%	0%	0%	0%	100%								40%	100%
GAS	-	0%	0%	100%	0%	0%	0%	0%	0%	100%	0%	0%	100%	0%	0%	0%	0%	0%	100%	10%	10%	20%	30%				30%	100%
BMS	-	0%	0%	0%	100%	0%	0%	0%	0%	100%	0%	0%	0%	100%	0%	0%	0%	0%	100%	15%	20%	35%					30%	100%
Heat	-	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%								100%	100%
H2	-	0%	0%	100%	0%	0%	0%	0%	0%	100%	0%	0%	100%	0%	0%	0%	0%	0%	100%								100%	100%
ELE	-	19%	12%	25%	0%	0%	40%	3%	1%	100%	11%	3%	29%	0%	0%	51%	6%	1%	100%								100%	100%
	-	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%									0%
	-	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%									0%

3 Energy efficiency

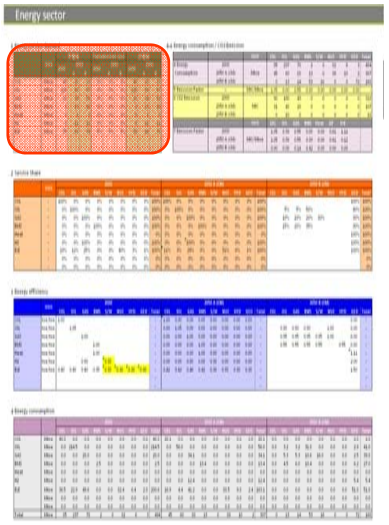
	Unit	2000 COL	OIL	GAS	BMS	S/W	NUC	HYD	GEO	Total	2050 A (CM) COL	OIL	GAS	BMS	S/W	NUC	HYD	GEO	Total	2050 B (CM) COL	OIL	GAS	BMS	S/W	NUC	HYD	GEO	Total
COL	toe/toe	1.00								-	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-								8.00	-
OIL	toe/toe		1.05							-	0.00	1.05	0.00	0.00	0.00	0.00	0.00	0.00	-	0.90	0.90	0.90			1.00		8.00	-
GAS	toe/toe			1.00						-	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	-	0.95	0.95	0.95	0.95	1.00			6.00	-
BMS	toe/toe				1.00					-	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	-	0.55	0.55	0.55	0.55			0.55	0.80	-
Heat	toe/toe				1.00					-	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	-								1.11	-
H2	toe/toe			0.90		0.38				-	0.00	0.00	0.90	0.00	0.38	0.00	0.00	0.00	-								2.00	-
ELE	toe/toe	0.40	0.40	0.40	0.35	0.38	0.38	0.38	0.38	-	0.42	0.42	0.46	0.42	0.38	0.38	0.38	0.38	-								1.50	-
										-									-									-
										-									-									-

4 Energy consumption

		2000 COL	OIL	GAS	BMS	S/W	NUC	HYD	GEO	Total	2050 A (CM) COL	OIL	GAS	BMS	S/W	NUC	HYD	GEO	Total	2050 B (CM) COL	OIL	GAS	BMS	S/W	NUC	HYD	GEO	Total
COL	Mtoe	48.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48.8	28.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	2.8
OIL	Mtoe	0.0	214.5	0.0	0.0	0.0	0.0	0.0	0.0	214.5	0.0	56.0	0.0	0.0	0.0	0.0	0.0	0.0	56.0	0.0	3.2	3.2	31.8	0.0	0.0	0.0	2.9	41.0
GAS	Mtoe	0.0	0.0	28.0	0.0	0.0	0.0	0.0	0.0	28.0	0.0	0.0	34.1	0.0	0.0	0.0	0.0	0.0	34.1	0.0	5.3	5.3	10.6	16.0	0.0	0.0	2.5	39.8
BMS	Mtoe	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0	2.5	0.0	0.0	0.0	13.4	0.0	0.0	0.0	0.0	13.4	0.0	4.5	6.0	10.4	0.0	0.0	0.0	6.2	27.0
Heat	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H2	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.4	0.0	0.0	0.0	0.0	0.0	12.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4	5.4
ELE	Mtoe	36.5	22.9	49.6	0.0	0.0	82.4	6.4	2.8	200.6	16.9	4.4	41.2	0.0	0.0	88.5	9.8	2.4	163.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.8	51.8
	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	Mtoe	85	237	78	2	0	82	6	3	494	45	60	88	13	0	89	10	2	307	0	13	14	53	16	0	0	72	168

Modified point

- Service demands are decided already (no need to fill in service demands)
  - Electricity required in each sector have to meet electricity supply.
  - Set the transmission losses.

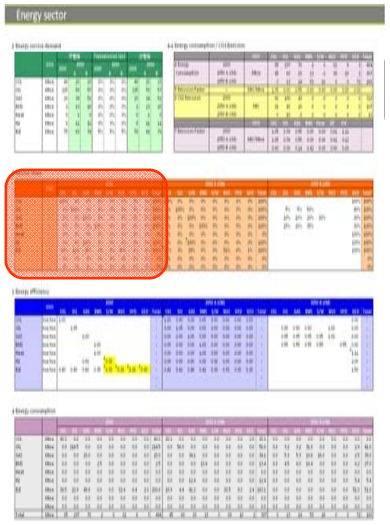


1 Energy service demand

	Unit	受電端			Transmission loss			送電端		
		2000	2050		2000	2050		2000	2050	
			A	B		A	B		A	B
COL	Mtoe	49	28	23	0%	0%	0%	49	28	23
OIL	Mtoe	225	59	57	0%	0%	0%	225	59	57
GAS	Mtoe	28	34	51	0%	0%	0%	28	34	51
BMS	Mtoe	2	13	16	0%	0%	0%	2	13	16
Heat	Mtoe	0	1	0	0%	0%	0%	0	1	0
H2	Mtoe	0	11	11	0%	0%	0%	0	11	11
ELE	Mtoe	75	63	74	5%	5%	5%	79	66	78

Modified point

- Set mixture of energy.
  - You can assume energy shift in 2050.
  - Refer to energy balance table (IEA) to calculate fuel mix in base year.

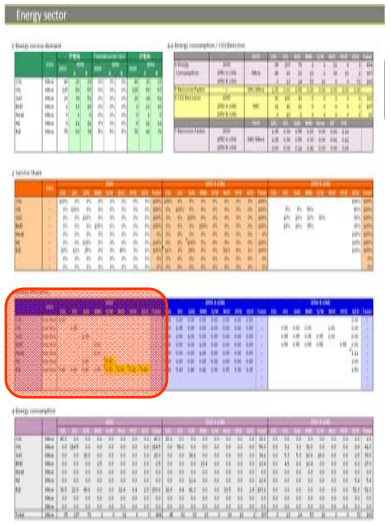


2 Service Share

	Unit	2000								
		COL	OIL	GAS	BMS	S/W	NUC	HYD	GEO	Total
COL	-	100%	0%	0%	0%	0%	0%	0%	0%	100%
OIL	-	0%	100%	0%	0%	0%	0%	0%	0%	100%
GAS	-	0%	0%	100%	0%	0%	0%	0%	0%	100%
BMS	-	0%	0%	0%	100%	0%	0%	0%	0%	100%
Heat	-	0%	0%	0%	0%	0%	0%	0%	0%	0%
H2	-	0%	0%	100%	0%	0%	0%	0%	0%	100%
ELE	-	19%	12%	25%	0%	0%	40%	3%	1%	100%
	-	0%	0%	0%	0%	0%	0%	0%	0%	0%
	-	0%	0%	0%	0%	0%	0%	0%	0%	0%

Modified point

- Set thermal / energy efficiencies.
  - Set thermal efficiency / additional energy use rate in oil transformation.
  - Set substitutive value in efficiencies for renewables / nuclear, etc.
  - In Japanese case, 0.38 (= efficiency of thermal plant) has been used.

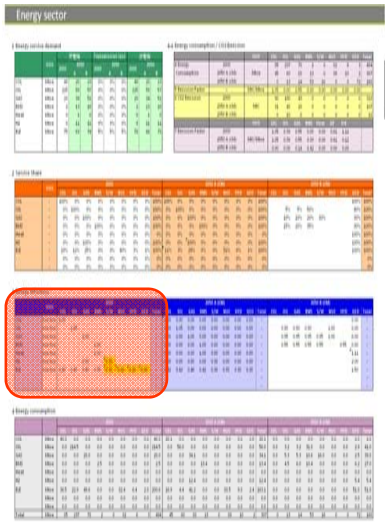


3 Energy efficiency

	Unit	2000								
		COL	OIL	GAS	BMS	S/W	NUC	HYD	GEO	Total
COL	toe/toe	1.00								-
OIL	toe/toe		1.05							-
GAS	toe/toe			1.00						-
BMS	toe/toe				1.00					-
Heat	toe/toe				1.00					-
H2	toe/toe									-
ELE	toe/toe	0.40	0.40	0.40	0.35	0.38	0.38	0.38	0.38	-
										-
										-

EBT convention

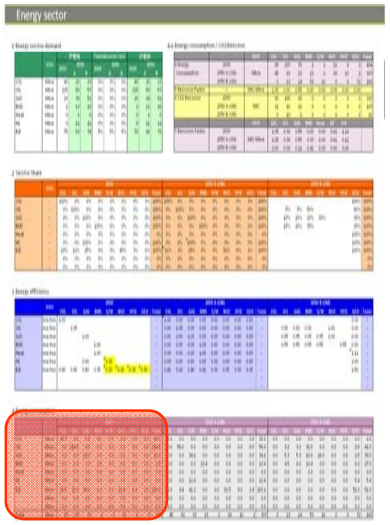
- Conventions for primary energy (Renewables, Nuclear, Hydro, and Geothermal)
  - *The partial substitution method:*
    - The amount of energy that would be necessary to generate an identical amount of electricity in conventional thermal power plants
  - *The physical energy content method (IEA)*
    - Renewables, Hydro: 100%
    - Geothermal (electricity): 10%
    - Geothermal (Heat): 50%
    - Nuclear: 33%



Contents

Modified point

- Primary energy consumption / CO2 emission will be calculated automatically.



4 Energy consumption

		2000								
		COL	OIL	GAS	BMS	S/W	NUC	HYD	GEO	Total
COL	Mtoe	48.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48.8
OIL	Mtoe	0.0	214.5	0.0	0.0	0.0	0.0	0.0	0.0	214.5
GAS	Mtoe	0.0	0.0	28.0	0.0	0.0	0.0	0.0	0.0	28.0
BMS	Mtoe	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0	2.5
Heat	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H2	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ELE	Mtoe	36.5	22.9	49.6	0.0	0.0	82.4	6.4	2.8	200.6
	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mtoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	Mtoe	85	237	78	2	0	82	6	3	494

5 CO2 Emission

		2000								
		COL	OIL	GAS	BMS	S/W	NUC	HYD	GEO	Total
COL	MtC	51	0	0	0	0	0	0	0	51
OIL	MtC	0	172	0	0	0	0	0	0	172
GAS	MtC	0	0	15	0	0	0	0	0	15
BMS	MtC	0	0	0	0	0	0	0	0	0
Heat	MtC	0	0	0	0	0	0	0	0	0
H2	MtC	0	0	0	0	0	0	0	0	0
ELE	MtC	38	18	27	0	0	0	0	0	84
	MtC	0	0	0	0	0	0	0	0	0
	MtC	0	0	0	0	0	0	0	0	0
Total	MtC	90	190	43	0	0	0	0	0	322

Modified point

We have to set ESS parameters in base year, before using BCM. And…

- Parameters in target year are set in BCM.
  - The old version ESS required service share / energy efficiency in target year.
  - No need to fill in the parameters in target year.
- They will be described in other format which is prepared in back cast model.
  - Details will be explained on Wednesday by Ashina-san.

Contents

Thank you for your attention!!