

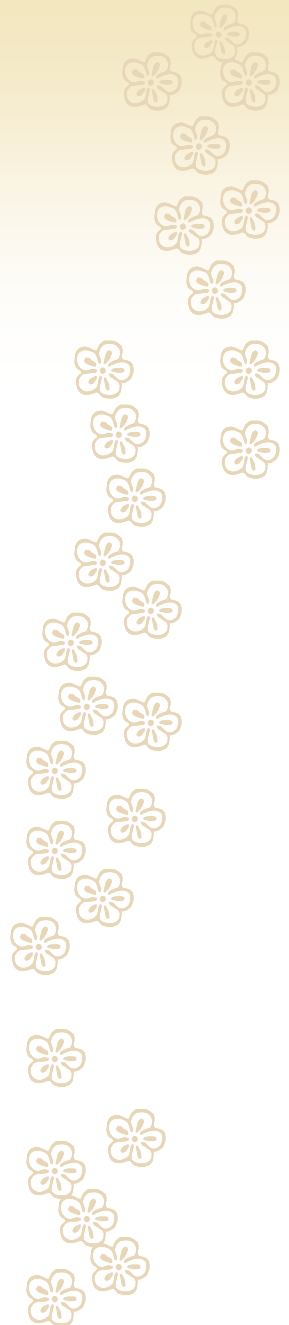
AIM/Enduse Model

2006 AIM Training Workshop
2006/10/16-20 @NIES

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Mizuho Information & Research Institute



Tutors of AIM/Enduse Model

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Mr. Hibino	Mizuho Information & Research Institute
Ms. Miyashita	Mizuho Information & Research Institute

Schedule related to AIM/Enduse Model

Date	Time	Contents
10/17 (Tue.)	13:00-14:30	[1] What is AIM/Enduse Model? [2] How to operate AIM/Enduse Model
	14:00-14:30	<i>Coffee Break</i>
	14:50-16:20	[2] How to operate AIM/Enduse Model (Cont.)
	16:20-16:40	<i>Coffee Break</i>
	16:40-18:00	[3] Exercise1 [4] Exercise2
10/18 (Wed.)	9:00-10:40	[5] How to develop AIM/Enduse input data
	13:00-14:20	[6] Exercise3
	17:00-18:00	[7] Self-learning <i>AIM/Enduse Model or Energy Snapshot Tool or others</i>
10/19 (Thr.)	14:40-16:40	[8] Self-learning <i>AIM/Enduse Model or Energy Snapshot Tool or others</i>

Schedule is flexible!

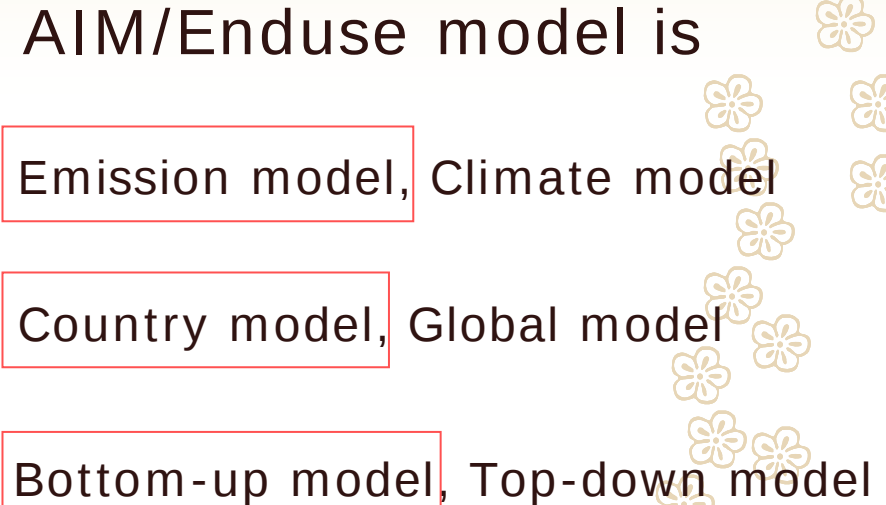
[1] What is AIM/Enduse Model?



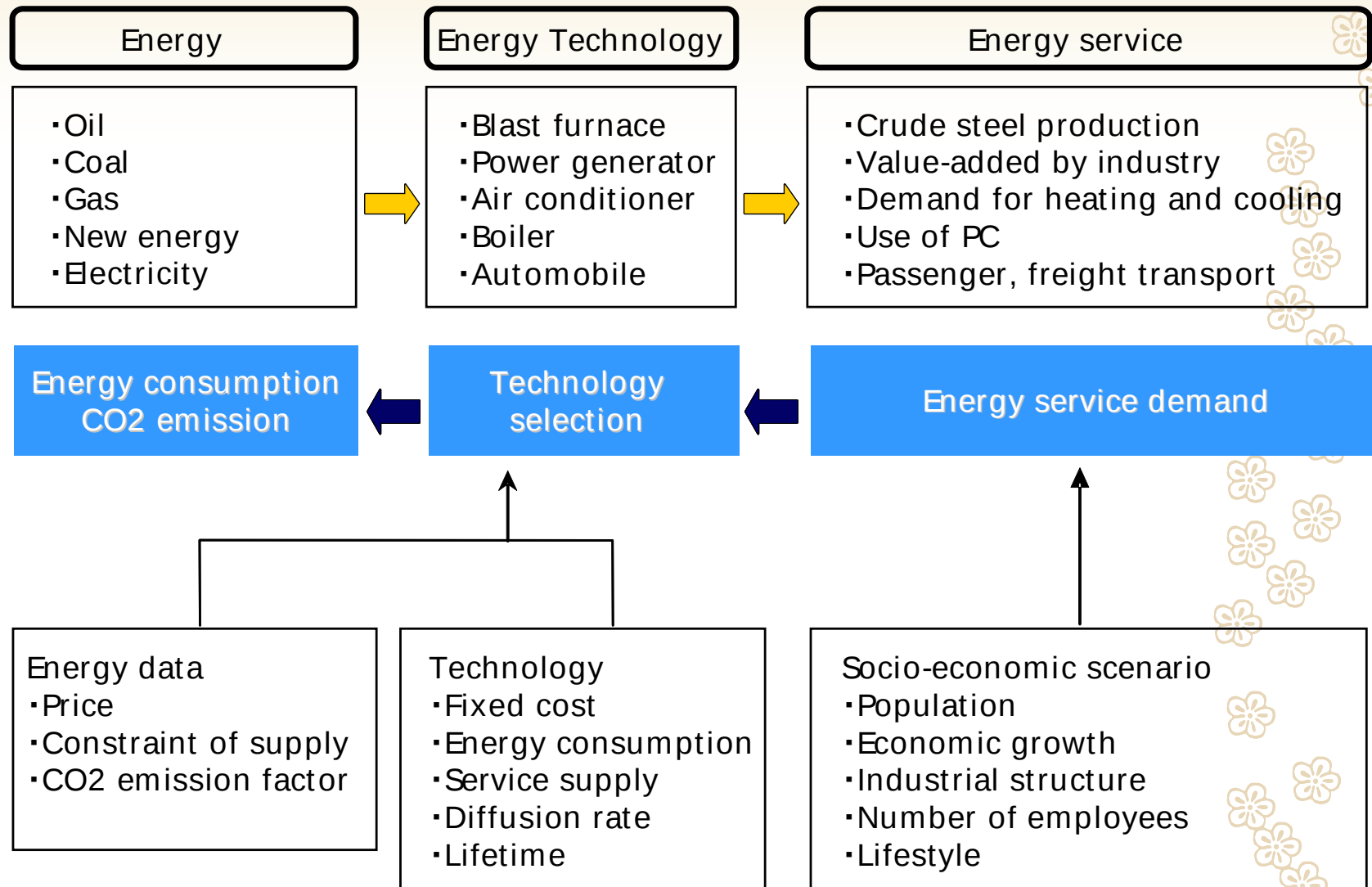
Characteristics of AIM/Enduse Model

- Bottom-up type technology selection model
- Technology selection is based on a linear optimization framework in which total costs are minimized by several constraints such as service demands and energy supply.
- Analysis tool for policies related to global warming and local air pollution like emission tax, subsidy, regulation and so on

MIZUHO Mizuho Information & Research Institute



Structure of AIM/Enduse Model



Formulation of technology selection

1) Objective function

Minimize Total Cost (TC)

$$\begin{aligned} TC = & \text{Annualized initial cost} \\ & + \text{Operating and management cost} \\ & + \text{Energy cost} \\ & + \text{Payment for energy tax} \\ & + \text{Payment for emission tax} \end{aligned}$$

For more details, refer to the AIM/Enduse Manual.

Formulation of technology selection

2) Constraints

- Allowable maximum limit of gas emission

$$Q^m(m) \leq \hat{Q}(m)$$

$Q^m(m)$: Emission of gas m

$\hat{Q}(m)$: Allowable maximum limit on emission of gas m

- Service demand

$$D(j) \leq A(j,l) \cdot X(l)$$

$D(j)$: Service demand quantity of service type j

$A(j,l)$: Service output of service j per operating unit of device l

$X(l)$: Operating quantity of device l

- Energy supply constraints

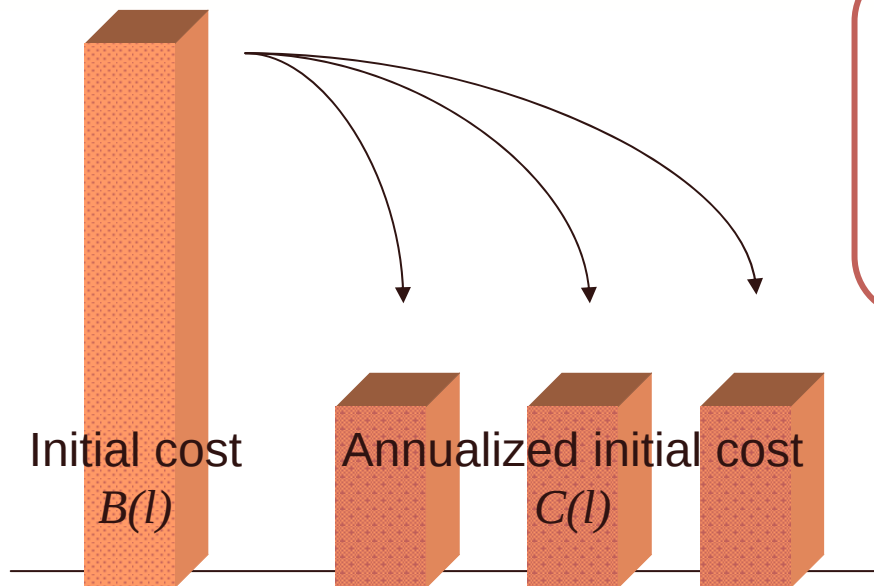
$$E(k,l) \cdot X(l) \leq \hat{E}(k)$$

$E(k,l)$: Energy use of energy kind k per operating unit of device l

$\hat{E}(k)$: Allowable maximum supply quantity of energy kind k

etc...

Annualizing initial cost



➤ Annualized Life-cycle cost method

$$C(l) = B(l) \cdot \frac{\alpha(1+\alpha)^T}{(1+\alpha)^T - 1}$$

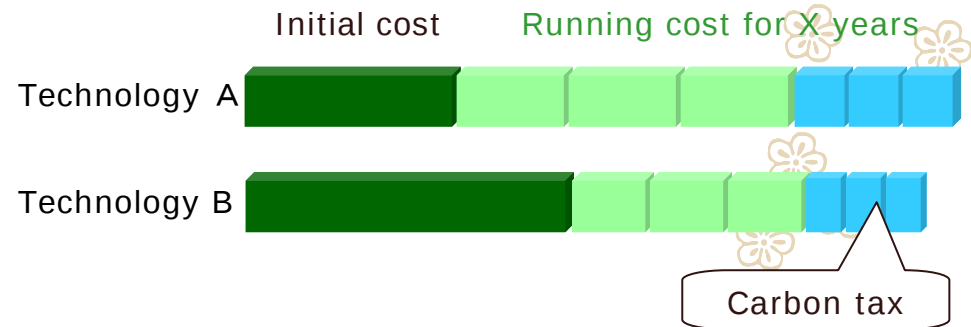
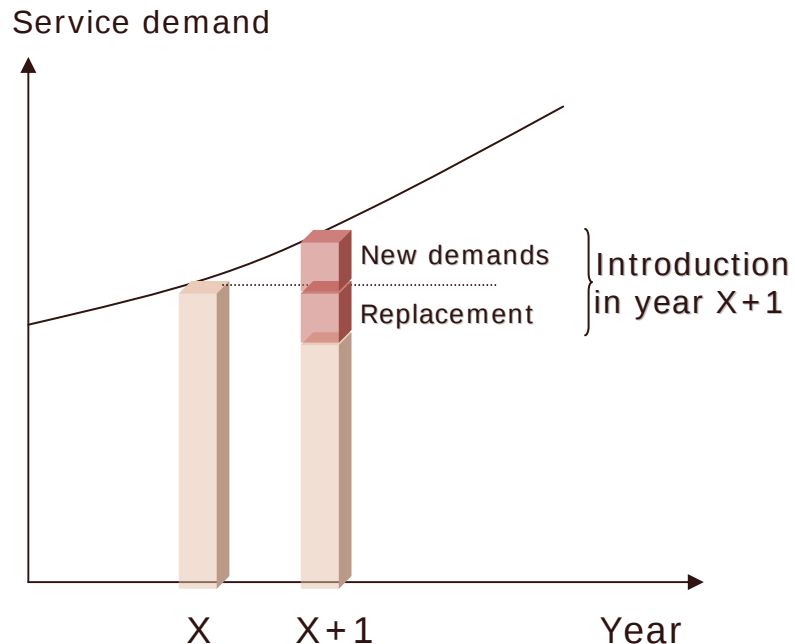
➤ Payback time period method

$$C(l) = \frac{B(l)}{\min(T, L)}$$

α : Discount rate
 T : Life of device l
 L : Payback Period

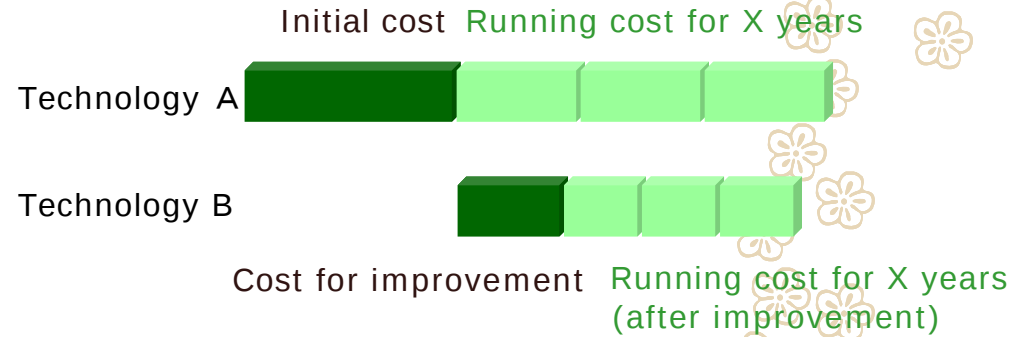
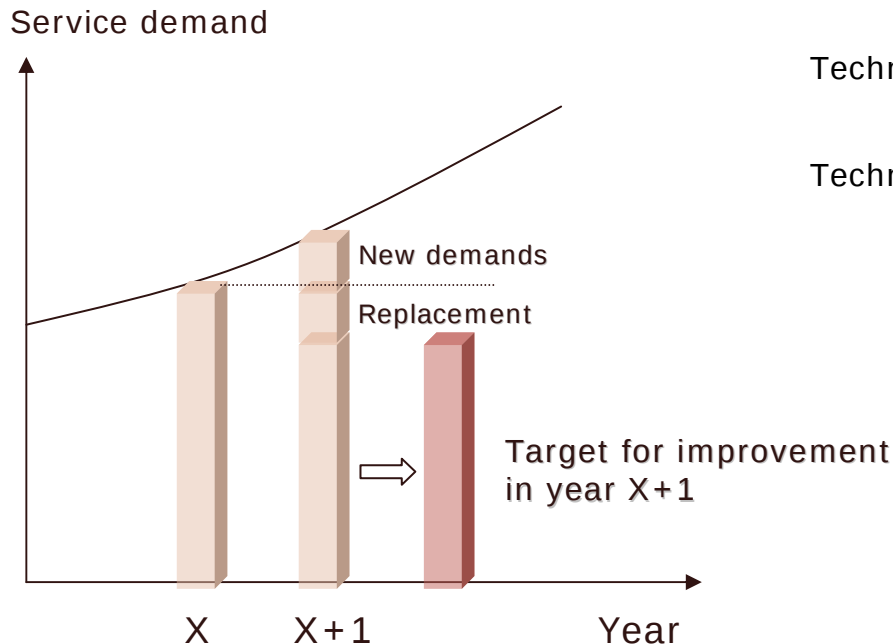
Examples of technology selection

1) Recruitment of new technology



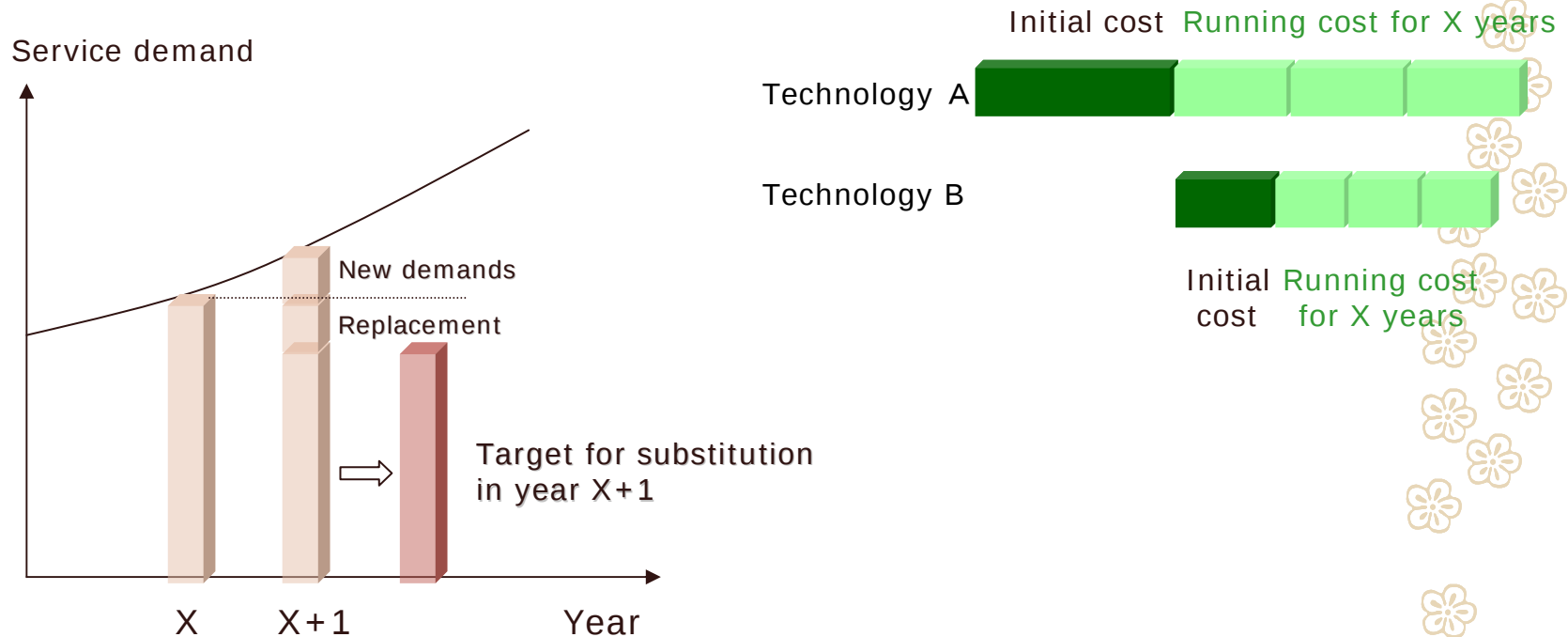
Examples of technology selection

2) Improvement of existing technology

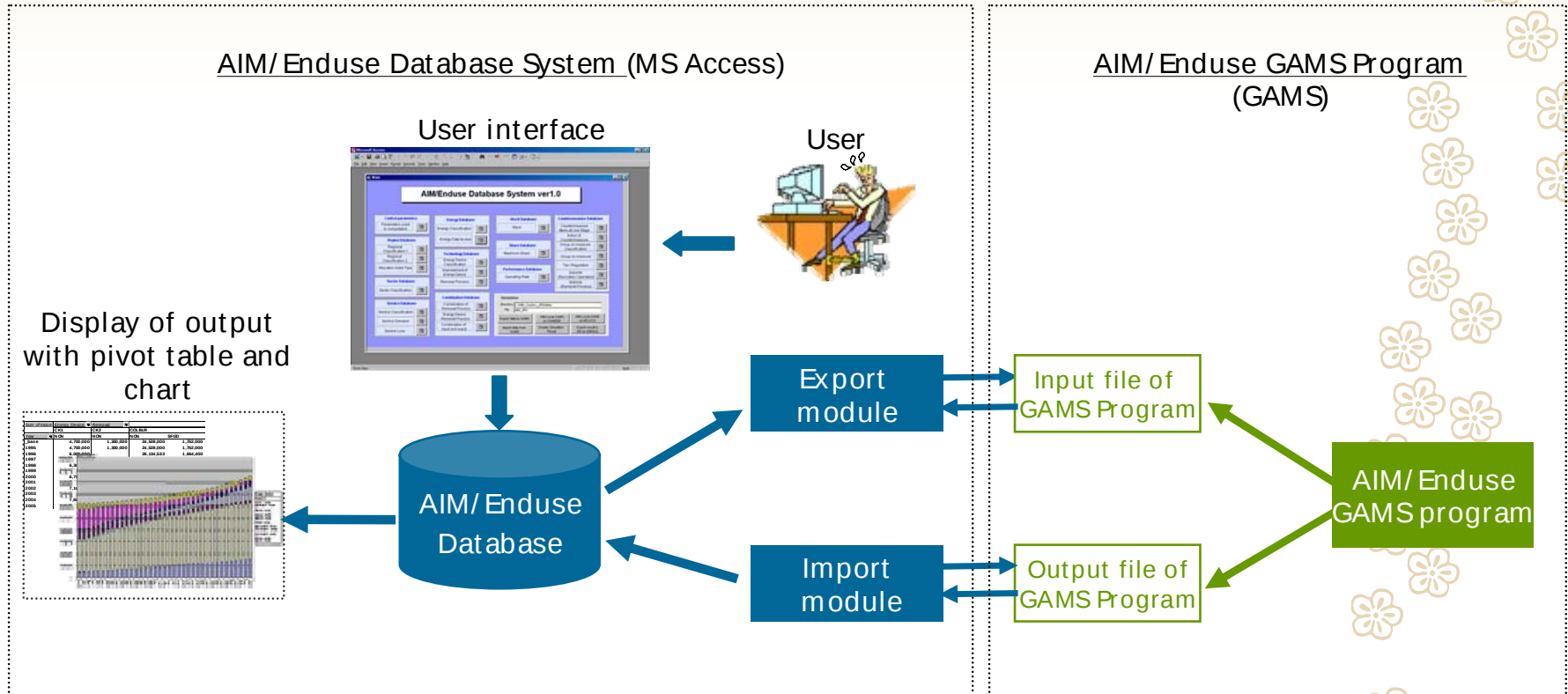


Examples of technology selection

3) Replacement of existing technology

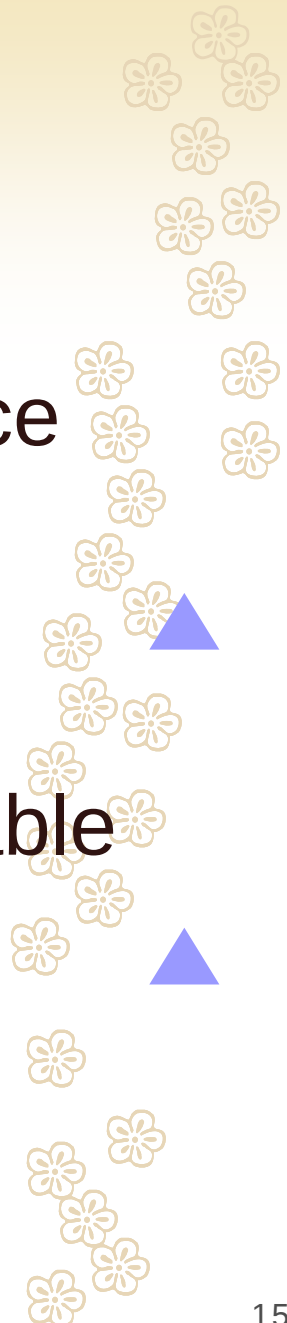


AIM/Enduse Software

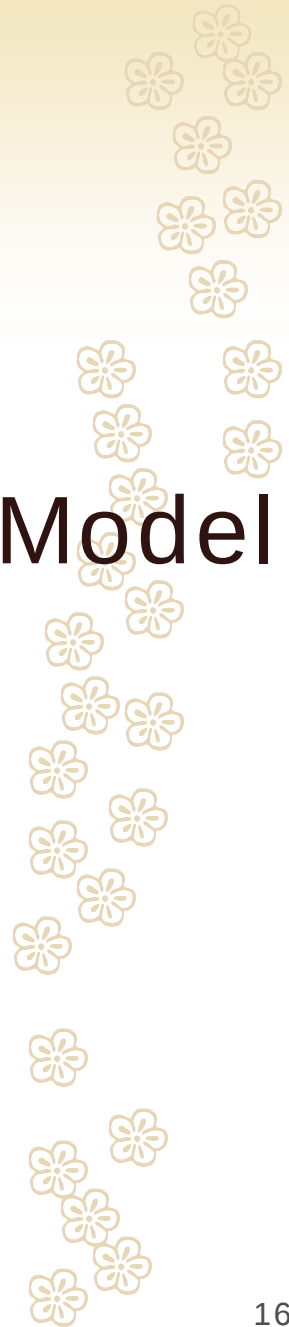


Definition of terms

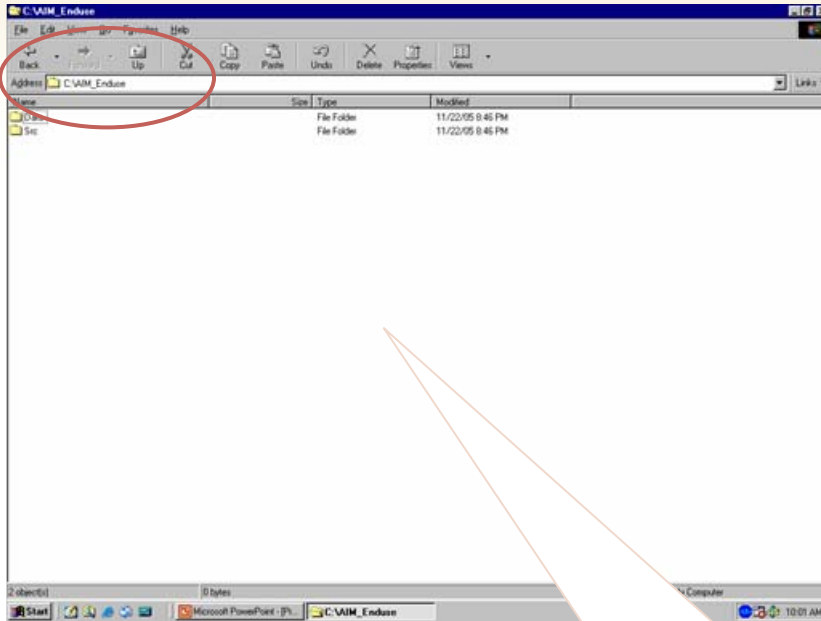
- “Energy technology” refers to a device that provides a useful service by consuming energy
- “Energy service” refers to a measurable need that must be satisfied.



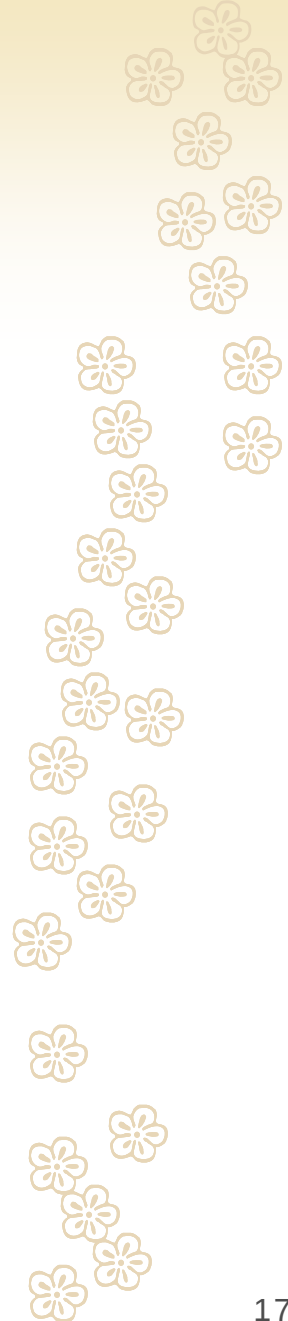
[2] How to operate AIM/Enduse Model



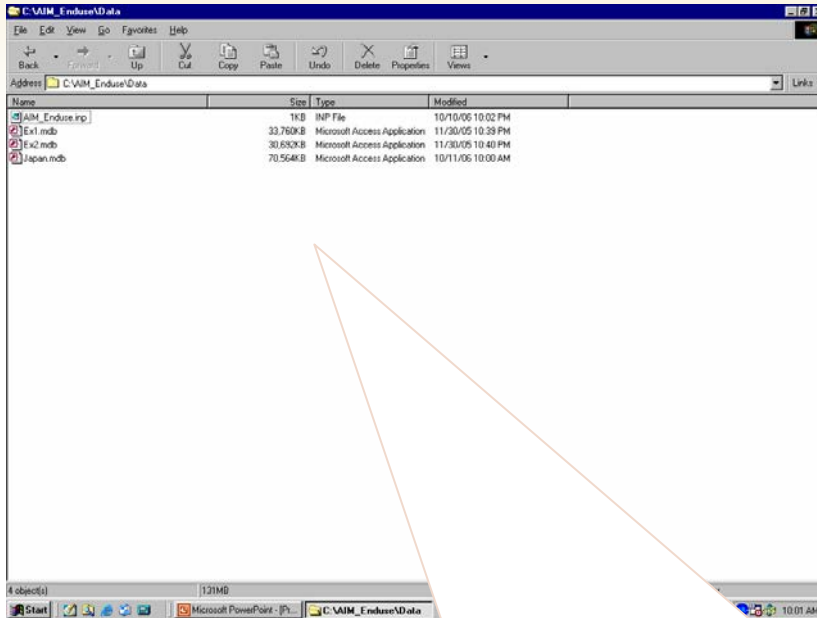
Installation (1)



Copy and Create a folder named
“AIM_Enduse” under your working
folder



Installation (2)

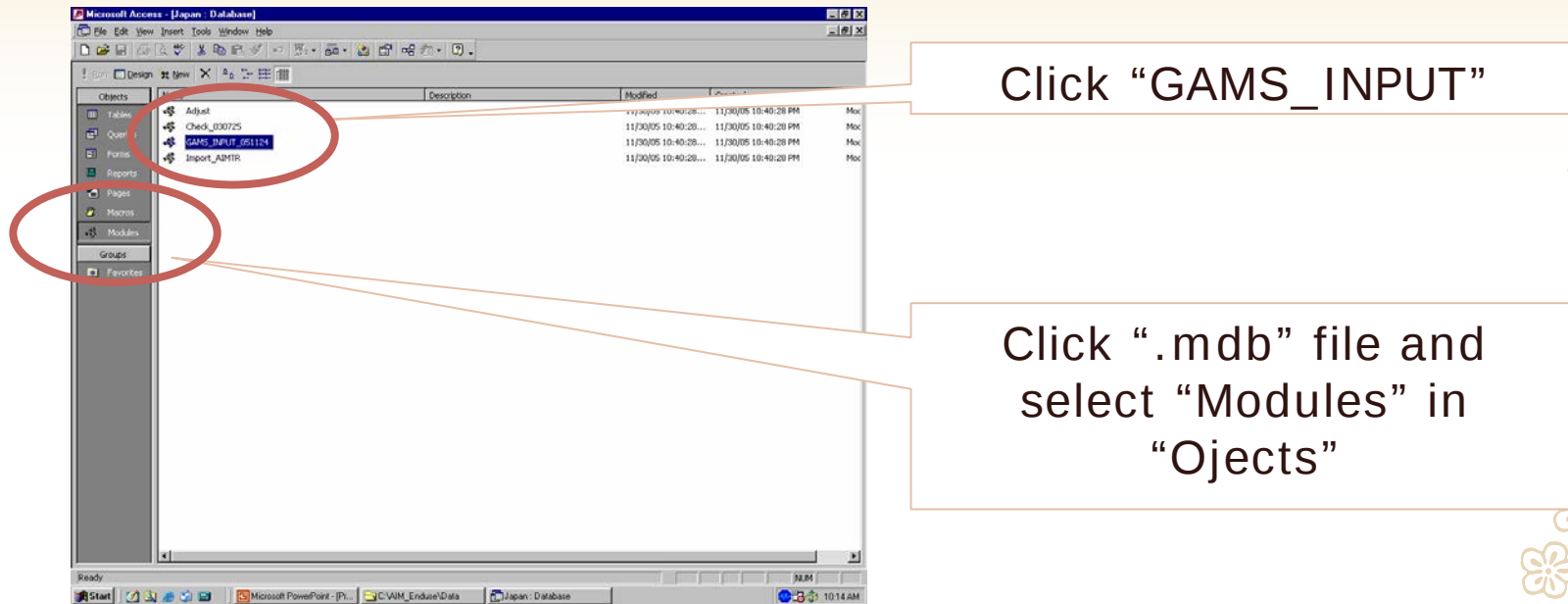


Make sure these files are in “data” folder

- AIM_Enduse.mdb AIM/Enduse database system
- Japan.mdb AIM/Enduse database system (Japanese model)
- Ex1(answer).mdb AIM/Enduse database system (Exercise 1)
- Ex2(answer).mdb AIM/Enduse database system (Exercise 2)
- AIM_Enduse.inp Control file

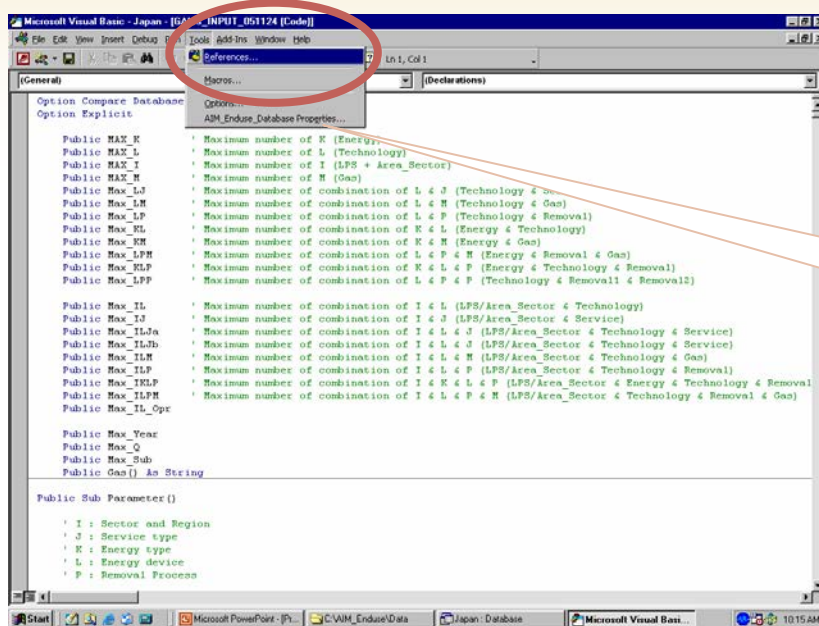


Installation (3)



“Microsoft DAO Object Library” and “Microsoft ADO Ext. 2.5 for DDL and Security” is required to operate AIM/Enduse Model.

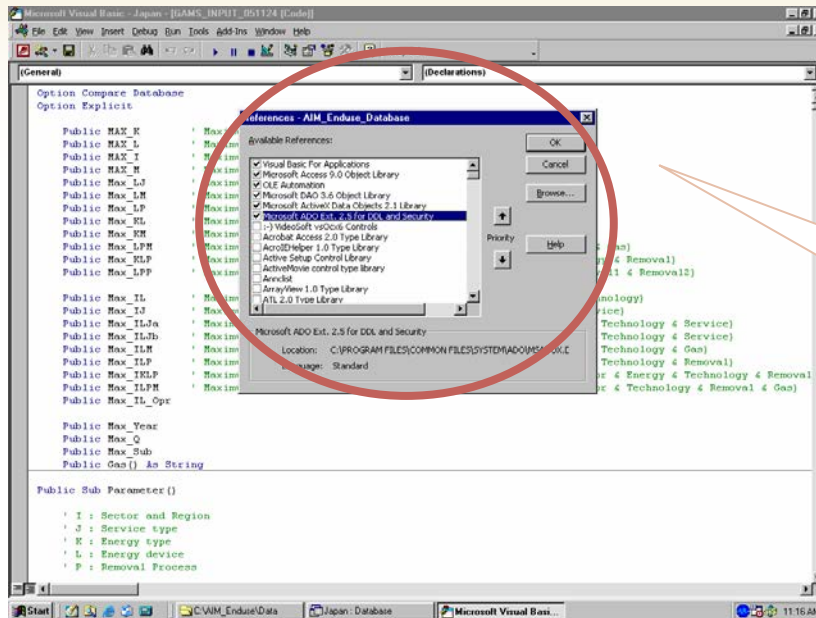
Installation (4)



Select “Tools” - “Reference”

“Microsoft DAO Object Library” and “Microsoft ADO Ext. 2.5 for DDL and Security” is required to operate AIM/Enduse Model.

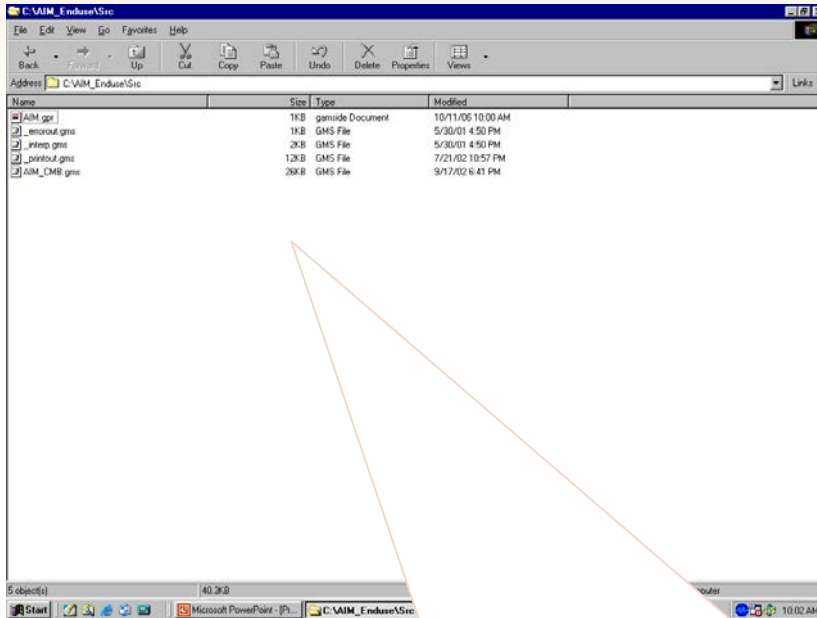
Installation (5)



Set references to this
order
Refer P11 of AIM/Enduse
Manual

“Microsoft DAO Object Library” and “Microsoft ADO Ext. 2.5 for DDL and Security” is required to operate AIM/Enduse Model.

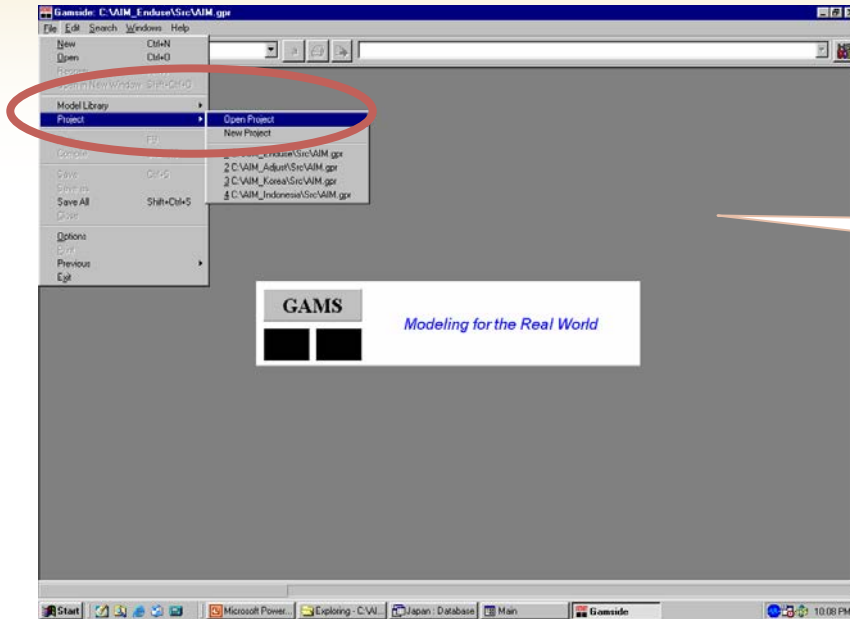
Installation (6)



Make sure these files are in “src” folder

- AIM_CMB.gms AIM/Enduse GAMS program (main)
- _errorout.gms AIM/Enduse GAMS program (sub)
- _interp.gms AIM/Enduse GAMS program (sub)
- _printout.gms AIM/Enduse GAMS program (sub)

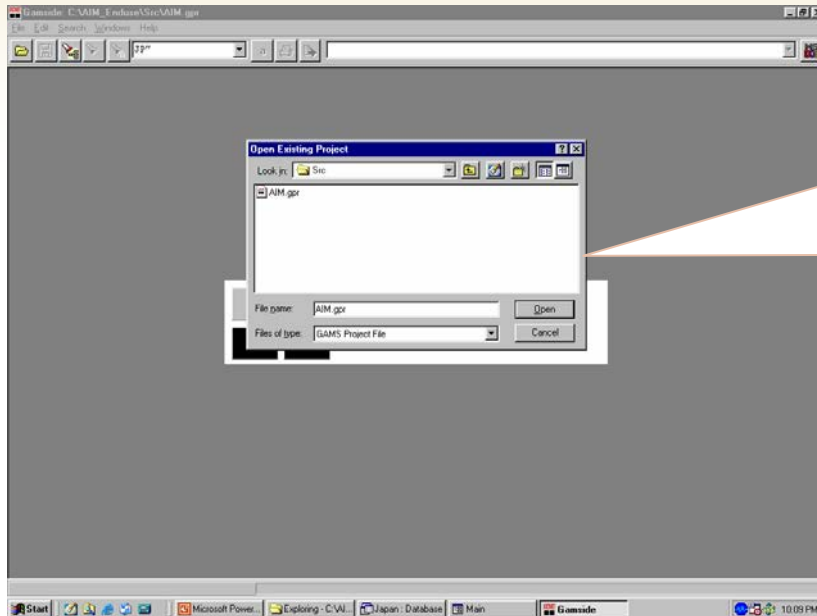
Installation (7)



Select “File” – “Project” –
“Open project”

GAMSIDE is a graphical interface to run GAMS. Before executing GAMS, “GAMS project file” need to be created under “src” directory.

Installation (8)

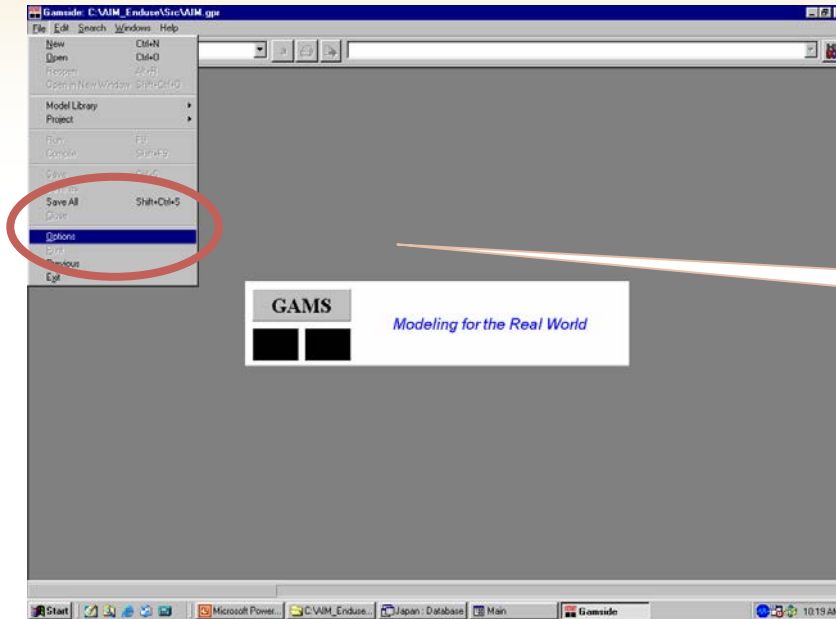


Open “AIM.gpr” in
C¥AIM_Enduse¥Src

If you want to work under
different directory, please
create a “new project”.

GAMSIDE is a graphical interface to run GAMS.
Before executing GAMS, “GAMS project file”
need to be created under “src” directory.

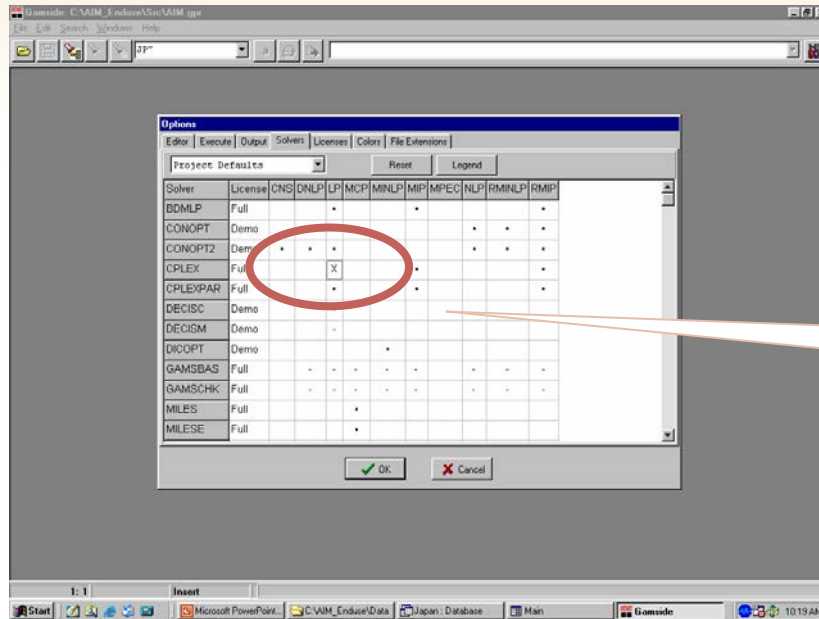
Installation (9)



Select "File" – "Options"

AIM/Enduse GAMS program needs "CPLEX" as linear programming solver.

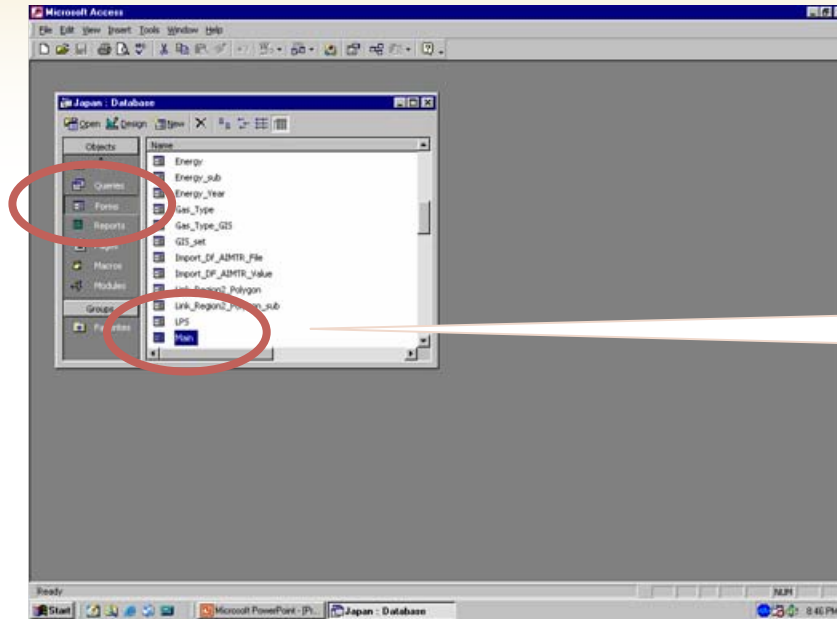
Installation



Select “CPLEX” as a solver

AIM/Enduse GAMS program needs “CPLEX” as linear programming solver.

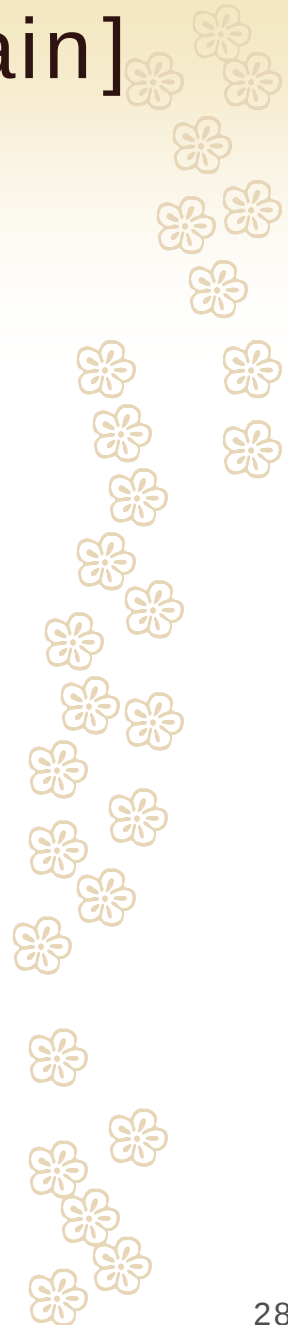
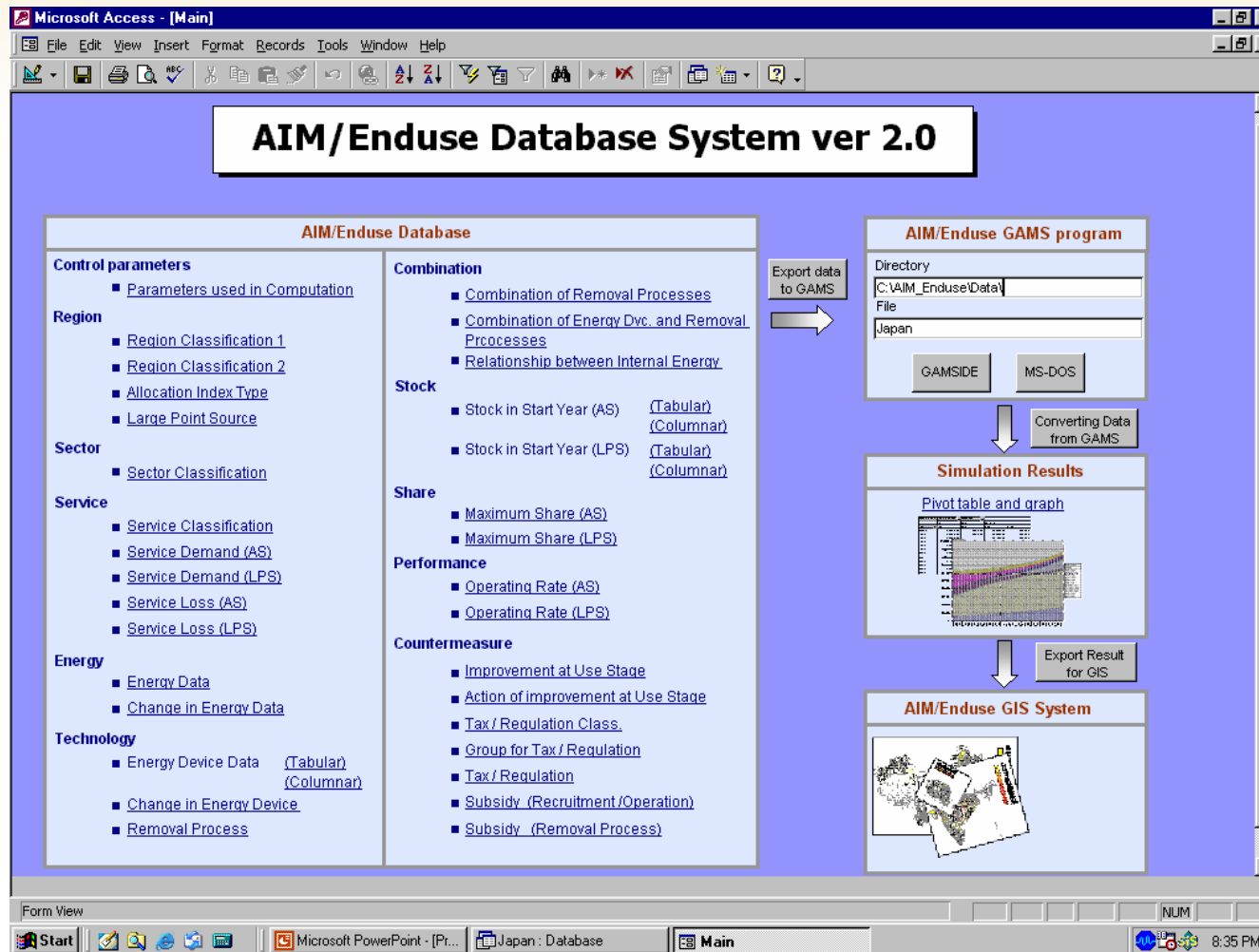
AIM/Enduse Database System



Select “Forms” and click
“Main”

AIM/Enduse Database System is in Microsoft
Access

AIM/Enduse Database System [Main]



Parameters used in computation

Microsoft Access - [Parameters used in computation]

Parameters used in computation

Start year of calculation * 1998

End year of calculation * 2020

Discount rate * 30.00%

Unit of Price yen

Unit of Energy 10⁶kcal

No.	Code	Unit
1	CO2	kg-C
2	SO2	kg-SO2
3	NOx	kg-NO2

Record Source: Year_Gas_Type

Form View

Start Microsoft PowerPoint Japan Database Main Parameters

Enter

- Codes of gases
- Unit of gases

Enter

- Start year of calculation
- End year of calculation
- Discount rate
- Unit of Price
- Unit of Energy

This form specify unit of parameters, start year of calculation, end year of calculation, discount rate



Region Classification 1

Enter

- Region code
- Region name

This form specify the aggregated region classification.



Region Classification 2

No.	Region 2 Code	Region 2 Name	GIS Code	Region 1	Quantity of Allocation Index
1	1	Hokkaido	10000	Japan	82499
2	2	Aomori	10000	Japan	8235
3	3	Iwate	10000	Japan	15270
4	4	Miyagi	10000	Japan	8801
5	5	Akita	10000	Japan	11434
6	6	Iyama	10000	Japan	7394
7	7	Iyama	10000	Japan	13762
8	8	Iyama	10000	Japan	6096
9	9	Iyama	10000	Japan	6408

Quantity of Allocation Index

Population (Million) Household (Thousand) GDP (Billion yen) GDP Secondary (Billion yen) GDP Tertiary (Billion yen) Household (Thousand) Population (Million)

Enter

- Region code
- Region name
- Area
- Indices for allocation

Indices for allocation corresponds to the next form

This form specify the detailed region classification.

Allocation Index Type

No.	Index Code *	Index Name *
1	POP	Population (Million)
2	HHH	Household (Thousand)
3	GDP	GDP (Billion yen)
4	GDP_1	GDP Primary (Billion yen)
5	GDP_2	GDP Secondary (Billion yen)
6	GDP_3	GDP Tertiary (Billion yen)

Record Source: Allocation Index Type
Record: 1 of 6
Form View

Enter

- Index code and name for allocation

The emissions are calculated by region classification1 firstly, then allocated to region classification2 based on these indices.



Large Point Source

No	LPS Code *	LPS Name *	GIS Code *	Region 2 *	Operation Rate *	Longitude	Latitude	Stack Height
----	------------	------------	------------	------------	------------------	-----------	----------	--------------

Enter

- LPS code
- LPS name
- GIS code
- Operation rate
- Longitude
- Latitude
- Stack height

This form specify large point sources.

Sector Classification

No.	Sector Code	Sector Name	Allocation Index
1001	CV-ELI	Power generation	10
1002	CV-TGS	Town gas production	10
1003	CV-OIL	Oil refining	10
2001	IN-STL	Industry - Steel	20
2002	IN-PAP	Industry - Paper	20
2003	IN-CEM	Industry - Cement	20
2004	IN-PET	Industry - Petrochemicals	20
2005	IN-AGR	Industry - Agriculture	20
2006	IN-MIN	Industry - Mining	20
2007	IN-CON	Industry - Construction	20
2008	IN-FOO	Industry - Food	20
2009	IN-TXT	Industry - Textile	20
2010	IN-OC	Industry - Other Ceramics	20
2011	IN-OCHE	Industry - Other Chemicals	20
2012	IN-NF	Industry - Non Ferrous	20
2013	IN-MEM	Industry - Metal/Machinery	20
2014	IN-OTH	Industry - Other Manufacturing	20
3000	OT-RES	Residential	30
4000	OT-COM	Commercial	40
5000	TRANS	Transport	50

Enter

- Sector code
- Sector name

This form specifies the sector classification. AIM/Enduse shows emissions by each sector based on this classifications. Countermeasures can also be set by this classifications.

Service Classification

No.	Service Code	Service Name	Service Unit	Sector Name
1001	DAC	Cooling	1000 cal	[TOT.COM] Commercial
1002	DBH	Heating	1000 cal	[BA-OCF] Industry - Other Chemicals
1003	DHW	Hot Water	1000 cal	[BA-OCF] Industry - Other Chemicals
1004	DHT	Hot water (down gas area)	1000 cal	[BA-OCF] Industry - Other Chemicals
1005	DHP	Hot water (LPG area)	1000 cal	[BA-OCF] Industry - Other Chemicals
1006	COI	Cooling	1000m2	[TOT.RES] Residential
1007	CLP	Lighting (fluorescent)	1000m2	[TOT.COM] Commercial
1008	CLL	Lighting (incandescent)	1000m2	[TRANS] Transport
1009	CLX	Fire exit light	1000m2	[TOT.COM] Commercial
1010	COO	Mainframe	1000m2	[TOT.COM] Commercial
1011	COO	Duplicator	1000m2	[TOT.COM] Commercial
1012	COE	Elevator	1000m2	[TOT.COM] Commercial
1013	COF	FAX	1000m2	[TOT.COM] Commercial
1014	COG	Personal Computer	1000m2	[TOT.COM] Commercial
1015	COH	Pumping power for air conditioner	1000m2	[TOT.COM] Commercial
1016	COZ	Others	1000m2	[TOT.COM] Commercial
1017	ZVE	Electricity in commercial	1000 cal	[TOT.COM] Commercial
2001	DAC	Cooling	1000 cal	[TOT.RES] Residential
2002	DBH	Heating	1000 cal	[TOT.RES] Residential
2003	DHW	Hot Water	1000 cal	[TOT.RES] Residential
2004	DHT	Hot water (down gas area)	1000 cal	[TOT.RES] Residential
2005	DHP	Hot water (LPG area)	1000 cal	[TOT.RES] Residential
2006	CLL	Lighting	1000 cal	[TOT.RES] Residential
2007	CLP	Lighting (fluorescent)	1000 cal	[TOT.RES] Residential
2008	CLL	Lighting (incandescent)	1000 cal	[TOT.RES] Residential
2009	COA	Conventional refrigerator	Unit	[TOT.RES] Residential
2010	COB	Conventional heat source (underneath)	Unit	[TOT.RES] Residential

Record Source - Service_Type
Record: 1 of 292
Form View

Enter

- Service code
- Service name
- Service unit
- Corresponding sector

Data shown in forms are stored in table with names indicated here.

This form specifies the service classification.



Service Demand (Area Source)

No.	Region 1	Service	Year1	Value1	Year2	Value2	Year3	Value3	Year4
1001	JPN Japan	DAG Cooling (10^6 cal)	1990	641500000	2000	641500000	2010	236220000	2020
1002	JPN Japan	DAG Cooling (10^6 cal)	1990	1014500000	2000	1035990000	2010	1192110000	2020
1004	JPN Japan	DAG Warming (10^6 cal)	1990	500630000	2000	610130000	2010	702300000	2020
1005	JPN Japan	DAG Hot Water (10^6 cal)	1990	273240000	2000	261570000	2010	300990000	2020
1006	JPN Japan	DAG Hot water (LFO area) (10^6 cal)	1990	15640000	2000	15970000	2010	18380000	2020
1007	JPN Japan	DAG Cooling (100m2)	1990	13300000	2000	13680000	2010	15620000	2020
1008	JPN Japan	DAG Lighting (fluorescent) (100m2)	1990	2100000	2000	2240000	2010	2570000	2020
1009	JPN Japan	DAG Lighting (incandescent) (100m2)	1990	1800000	2000	1800000	2010	1800000	2020
1010	JPN Japan	DAG Free and light (100m2)	1990	18100000	2000	17000000	2010	17000000	2020
1011	JPN Japan	DAG Duplicator (100m2)	1990	16570000	2000	17000000	2010	17000000	2020
1012	JPN Japan	DAG Elevator (100m2)	1990	2000000	2000	2000000	2010	2000000	2020
1013	JPN Japan	DAG FAX (100m2)	1990	2000000	2000	2000000	2010	2000000	2020
1014	JPN Japan	DAG Personal Computer (100m2)	1990	2000000	2000	2000000	2010	2000000	2020
1015	JPN Japan	DAG Pumping power for air conditioner (100m2)	1990	2000000	2000	2000000	2010	2000000	2020
1016	JPN Japan	DAG Others (100m2)	1990	2000000	2000	2000000	2010	2000000	2020
1019	JPN Japan	DAG Electricity in commercial (10^6 cal)	1990	2000000	2000	2000000	2010	2000000	2020
2001	JPN Japan	DAG Cooling (10^6 cal)	1990	2000000	2000	2000000	2010	2000000	2020
2002	JPN Japan	DAG Warming (10^6 cal)	1990	2000000	2000	2000000	2010	2000000	2020
2003	JPN Japan	DAG Hot water (down gas area) (10^6 cal)	1990	2000000	2000	2000000	2010	2000000	2020
2004	JPN Japan	DAG Hot water (LFO area) (10^6 cal)	1990	2000000	2000	2000000	2010	2000000	2020
2005	JPN Japan	DAG Lighting (fluorescent) (10^6 cal)	1990	2000000	2000	2000000	2010	2000000	2020
2006	JPN Japan	DAG Lighting (incandescent) (10^6 cal)	1990	2000000	2000	2000000	2010	2000000	2020
2007	JPN Japan	DAG Conventional refrigerator (Units)	1990	2000000	2000	2000000	2010	2000000	2020
2008	JPN Japan	DAG Kotatsu (bald-head source underneath) (Units)	1990	2000000	2000	2000000	2010	2000000	2020
2009	JPN Japan	DAG Fan (Units)	1990	2000000	2000	2000000	2010	2000000	2020

Linearly supplemented between years

Enter

- Service demand in area source
- Corresponding year

This form specifies the service classification.

Service Loss (Area)

No.	Regional 1 *	Service *	Social service loss Rate *						
			Year1	Value1	Year2	Value2	Year3	Value3	Yes

Enter

- Service loss in area source (%)
- Corresponding year

Data for transmission and distribution loss between the producer and the receiver of energy service is defined here.



Energy Data

No.	Energy Code	Energy Name	Energy Price	CO2	CO2	CO2	Emission Factor
440	BIO	Biomass input used in CV-ELE	0.001	0	0	0	
430	BLK	Black Liquid	0.001	0	0	0	
101	COL	Coal	65	10.12	0.1	0	
106	CPR	Coal Products	65	12.3	0	0	
1	EL_OIL	Gasoline	8.9	19	0.004	0	
804	ELC	Electricity - Com	2068	0	0	0	
801	ELE	Electricity	7	0	0	0	
806	ELI	Electricity - Ind	1574	0	0	0	
805	ELM	Electricity - Com-Night	689	0	0	0	
803	ELN	Electricity - Res	974	0	0	0	
802	ELR	Electricity - Res-Night	2921	0	0	0	
807	ELS	Electricity - S	1574	0	0	0	
701	GEN		0.001	0	0	0	

Gases correspond to
“Parameter used in
computation”

If check box is not checked,
the data is constant for all the
years, if checked, data will
change according to the data
in “Change in energy data”

Enter

- Energy code
- Energy name
- Energy price
- Gas emission factor

Energy data is specified here.



Change in Energy Data

Microsoft Access - [Change in Energy Data]

Change in Energy Data

No.	Energy *	Energy Price or Emission Factor *	Energy Factor *							
			Year1	Value1	Year2	Value2	Year3	Value3	Year4	Value4
101	CO2 Coal	[Price] (Yen/t) (Bcal)	1999	61	2010	63	2020	64	2030	64
102	CO2 Gas	[Price] (Yen/t) (Bcal)	1999	55	2010	57	2020	58	2030	58
301	[CO2] Coal Products	[CO2] (kg CO2/t) (Bcal)	1999	145	2010	219	2020	231	2030	231
310	[EL CO2] Gasoline	[CO2] (kg CO2/t) (Bcal)	1999	338	2010	392	2020	388	2030	388
211	[EL] Electricity - Gen	[Price] (Yen/t) (Bcal)	1999	238	2010	294	2020	298	2030	298
212	[EL] Electricity - Ind	[Price] (Yen/t) (Bcal)	1999	238	2010	294	2020	298	2030	298
201	[EL] Electricity - Gen-Night	[Price] (Yen/t) (Bcal)	1999	157	2010	222	2020	234	2030	234
203	[EL] Electricity - Res-Night	[Price] (Yen/t) (Bcal)	1999	338	2010	392	2020	388	2030	388
304	[CO2] Gasoline	[Price] (Yen/t) (Bcal)	1999	1398	2010	1343	2020	1342	2030	1342
209	[CO2] Heavy oil	[Price] (Yen/t) (Bcal)	1999	522	2010	592	2020	598	2030	598
207	[CO2] Kerosene	[Price] (Yen/t) (Bcal)	1999	522	2010	592	2020	598	2030	598
208	[CO2] Diesel	[Price] (Yen/t) (Bcal)	1999	668	2010	738	2020	742	2030	742
230	[CO2] Other Petroleum Products	[Price] (Yen/t) (Bcal)	1999	338	2010	392	2020	388	2030	388
222	[CO2] LPG - Other	[Price] (Yen/t) (Bcal)	1999	1905	2010	1735	2020	1735	2030	1735
202	[CO2] Oil products	[Price] (Yen/t) (Bcal)	1999	338	2010	392	2020	388	2030	388
303	[CO2] Town Gas	[Price] (Yen/t) (Bcal)	1999	958	2010	1051	2020	1011	2030	1011

* On exit, data is updated automatically in "Energy Data" table with using data in this table.
Record Source: Energy_Year

Linearly supplemented between years

Enter

- Energy
- Items to be changed
- Future value

Future values of energy price, CO2 emission factor, SO2 emission are defined here. Data in this table is considered only when check box in "Energy data" is checked.

Energy Device Data

Microsoft Access - [Technology - Form]

File Edit View Insert Format Records Tools Window Help

Energy Device Data Update factor of energy device with checking

No.	Energy Device Code	Energy Device Name	Life Time	Device Unit	Specific Service Output (Year/Device unit)	Fixed Cost	Operation Cost	Specific Energy Consum
163	CEBOM	Biomass power plant	40	1kW	[Z12] Ele. Incl. Pumping (10 ⁹ cal)	67.81	0.001	[BIO] Biomass input used in
122	CECOL0	Flow control (coal)	1	1	[Z21] Ele. By oil plant (10 ⁹ cal)			
140	CEOP1	Conventional coal plant	40	1kW	[Z23] Ele. By coal plant (10 ⁹ cal)	71.57	2890000	[COL] Coal
141	CEOP2	Performance coal plant	40	1kW	[Z23] Ele. By coal plant (10 ⁹ cal)	71.57	2890000	[COL] Coal
102	CELE1	Ele. Ex. Pumping-up	1	1	[Z00] Ele. Before v...			
103	CELE2	Pumping-up power plant	40	1kW	[Z00] Ele. Before transmission (10 ⁹ cal)	75.34	882000	[Z12] CV-...
120	CEFLP	Flow control	1	1	[Z12] Ele. Incl. Pumping (10 ⁹ cal)	1	0.001	[Z20] CV-ELE-Intermed

Unit: Cost=Yen, Energy Consumption=10⁹cal
 * On exit, data is updated automatically in this table and "Stock" table with using data in "Improvement of energy device" table.
 Record source: Technology

Record: 1 of 766

Form View

Start Microsoft PowerPoint - [P...] Japan: Database Main Technology - Form 8:53 PM

If check box is not checked, the data is constant for all the years, if checked, data will change according to the data in "Change in energy device data"

Enter

- Technology code and name
- Life time
- Device unit
- Service output (code and quantity)

"Technology" includes two types of devices, "Energy device" and "Removal process". "Energy device" refers to the technologies which consumes energy and supply services.

Energy Device Data (Cont.)

Microsoft Access - [Technology : Form]

Energy device with checking

Service Output (year/device unit) *		Fixed Cost *	Specific Energy Consumption (year/device unit) *		Gas Emission, excluding Fuel Content	
Name	Quantity	Operation Cost	Quantity	Non-Ene	Quantity	Name
umping (10 ⁹ cal)	67.21	0.00	Business input used in	180.1		
			(NO _x) Business input used in			
			(NO _x) Waste Heat - First			
			(NO _x) Waste Heat - Com			
			(H ₂ O) Hydro power			
			(H ₂ O) Geothermal energy			
			(H ₂) Hydrogen			
			(ELU) Electricity - Res			
ed from fossil fuel (10 ⁹ cal)	1.18	00				
ed start (10 ⁹ cal)	71.57	2690000	CO ₂ Coal	181.2		
ed start (10 ⁹ cal)	71.57	2690000	CO ₂ Coal	181.4		
transmission (10 ⁹ cal)	1.18	0.00	[212] CV-ELU-Intermed	1		
transmission (10 ⁹ cal)	75.34	882000	[212] CV-ELU-Intermed	186.3		
umping (10 ⁹ cal)	1.18	0.00	[220] CV-ELU-Intermed	1		

Record: 11 of 716

Start Microsoft PowerPoint - [P] Japan Database Main Technology : Form 9/28/11 9:54 PM

Multiple service output and energy input can be set

Enter

- Energy input (code and quantity)
- Rate of energy for non-combustion
- Fixed cost
- Operation cost except energy
- Gas emission except energy

“Technology” includes two types of devices, “Energy device” and “Removal process”. “Energy device” refers to the technologies which consumes energy and supply services.

Energy Device Data (Columnar)

Microsoft Access - [Form 6-1]

File Edit View Insert Format Records Tools Window Help

Energy Device Data

Number: 101
 Device Code: CELOSS
 Device Name: Transmission loss 1
 Life Time (year): 1
 Device Unit: 1
 Fixed Cost (*1/device unit): 1
 Operation Cost (*1/device unit): 1

Specific Service Output (*1/year/device unit)

Name	Quantity
ELE Electricity (10 ⁶ cal)	1

Specific Energy Consumption (*1/year/device unit)

Name	Quantity	Non Energy Use
LOO Electricity input in energy conversion	1.05	0

Emission (*1/year/device unit)

Name	Quantity
SO2 (kg-SO2)	0
NOx (kg-NO2)	0

* On exit, data is updated automatically in this table and "Stock" table with using data in "Improvement of energy device" table.
 Record Source: Technology
 Record: 1 of 766
 Form View
 Microsoft PowerPoint - [P...]
 Japan: Database
 Main
 Form 6-1
 8:51 PM

“Energy Device Data” is shown in columnar in this form.



Change in Energy Device Data

Linearly supplemented
between years

Fixed cost, Operation cost,
Service output, Energy input
can be changed

Enter

- Energy device code and name
- Items to be changed
- Change rate
- Corresponding year

Future values of energy device data, energy input, service output and etc are defined here. Data in this table is considered only when check box in "Energy device data" is checked.

Removal Process

Microsoft Access [Form 6-3]

File Edit View Insert Format Records Tools Window Help

Removal Process

No.	Removal Process Code *	Removal Process Name *	Unit Type	Stage of Process *	Fixed Cost	Energy Consumption	Removed Gas 1, 2	Removed Gas 3, 4	
Unit of Removal Process					Operating Cost	Energy Cost	Rebate Factor	Gas	Removal Rate
5	SHMF3	Hot FGD-Heavy fuel oil and gas-3	Energy	Post-combustion	133	[CO2] Coal	SO2	95.00%	
			Energy	Pre-combustion	7	[CO2] Coal	CO2		
			Service Unit	In Situ combustion	253	[CPR] Coal Products	SO2		
			Unit	Post-combustion	15	[OLE] Crude Oil	NOx	20%	
			Unit	Pre-combustion	15	[OLE] Crude Oil	NOx		
7	SHMF3	Adv FGD-Heavy fuel oil and gas-3	Energy	Post-combustion	318	[CPR] Oil products			
			Oil	Crude Oil	13	[OLE] Crude Oil			
			Oil	Crude Oil					
9	HPF3	Hard Coal-SCR-300MMth	Energy	Post-combustion					
			Oil	Crude Oil					
13	HPF32	Oil and Gas-OM-SCR-300MMth	Energy	Post-combustion	31	[CO2] Coal	NOx	80.00%	
			Oil	Crude Oil	5	0.003			
41	SHMF31	Hot FGD-Hard coal-300MMth	Energy	Post-combustion	148	[CO2] Coal	SO2	95.00%	
			Oil	Crude Oil	8	0.0766			
42	SHMF32	Hot FGD-Hard coal-300MMth	Energy	Post-combustion	148	[CO2] Coal	SO2	95.00%	
			Oil	Crude Oil	8	0.009			
43	SHMF33	Hot FGD-Hard coal-300MMth	Energy	Post-combustion	148	[CPR] Coal Products	SO2	95.00%	
			Oil	Crude Oil	8	0.009			
121	HPF322	Gas-SCR-300MMth	Energy	Post-combustion	25	[GAS] Natural gas	NOx	80.00%	
			Oil	Natural gas	3	0.003			
122	HPF32C	Oil-SCR-300MMth	Energy	Post-combustion	25	[OLE] Crude Oil	NOx	80.00%	
			Oil	Crude Oil	3	0.003			

* On exit, data is updated automatically in "Combination of removal process" and "Block" table.

Record Source: Removal

Records: 14 of 10

Form View

Start Microsoft PowerPoint - [P... Japan - Database Man Form 6-3 8:59 PM

Enter

- Removal process code and name
- Unit
- Stage of process
- Fixed cost
- Operating cost except energy
- Energy input
- Removed gas and removal rate

“Technology” includes two types of devices, “Energy device” and “Removal process”. “Removal process” refers to the technologies which removes air pollutants emitted by energy device.

Combination of Removal Process

Microsoft Access - [Form 7-1]

Combination of Removal Processes

Update Removal Rate etc.

Code	Name	Precombustion	Removal Process in Site Combustion	Postcombustion
FOG_SCO	FOG & SCR - Hard coal			SHMP32 Wet FOG-Hard coal-300MMth SHOAF2 Adv FOG-Heavy fuel oil and gas NPHG3 Hard Coal-SCR-300MMth NPO323 Oil and Gas-OM-SCR-300MMth SHMP31 Wet FOG-Hard coal-300MMth SHMP32 Wet FOG-Hard coal-300MMth SHMP33 Wet FOG-Hard coal-300MMth NPO323 Gas-SCR-300MMth NPO323 Oil-SCR-300MMth
FOG_SCO	FOG & SCR - Oil			
NPHG3	SCR - Hard coal			NPHG3 Hard Coal-SCR-300MMth
NPO32C	SCR - Fuel oil			NPO32C Gas-SCR-300MMth
NPO32D	SCR - Fuel oil			NPO32D Gas-SCR-300MMth
SHAF3	Advanced Desulfurization - Hard coal			
SHOAF3	Advanced Desulfurization - Fuel oil			

data is updated automatically in this table and "Stock" table
 Source : FOG_Mth
 Record : 33 of 10
 Form View

Enter

- Combination of Removal process code and name
- Select individual removal processes

Define combination of removal processes in case multiple removal processes are attached to one device.



Combination of Energy Device and Removal Process

Microsoft Access - [Form 7-2]

Combination of Energy Device and Removal Process

Energy Device

Combination of Removal Process

Code

Record

Energy devices are listed

Combination of removal process are listed

Code is automatically entered

Combination of energy device and removal process is defined here.



Relationship between Internal Energy/Services

Microsoft Access [Form 7-3]

File Edit View Insert Format Records Tools Window Help

Relationship between Internal Energy / Service

No	Internal Energy *	Internal Service *
[L61] Electricity - Supply use	[Z01] Ele. Demand from other csw. Sectors	[Z01] Ele. Demand from other csw. Sectors
[L62] Electricity - Supply use	[Z01] Ele. Demand from other csw. Sectors	[Z01] Ele. Demand from other csw. Sectors
[V51] V51	[Z12] Ele. Incl. Pumping	[Z12] Ele. Incl. Pumping
[VLS] VLS	[Z20] Ele. By gas plant	[Z20] Ele. By gas plant
[YR] YR	[Z23] Ele. By coal plant	[Z23] Ele. By coal plant
[YFA] YFA	[Z21] Ele. By oil plant	[Z21] Ele. By oil plant
[YCP] YCP	[Z20] Ele. Generated from fossil fuel	[Z20] Ele. Generated from fossil fuel
[YBS] YBS	[CT0] Town gas	[CT0] Town gas
[YBA] YBA	[COF] Oil products	[COF] Oil products
[ZAT1] Agr. - Energy Use	[ZAT1] Agr. - Energy Use	[ZAT1] Agr. - Energy Use
[ZAT2] Agr. - Steam Heat Use	[ZAT2] Agr. - Steam Heat Use	[ZAT2] Agr. - Steam Heat Use
[ZAT3] Agr. - Direct Heat Use	[ZAT3] Agr. - Direct Heat Use	[ZAT3] Agr. - Direct Heat Use
[ZAA] Agr. - Electricity Use	[ZAA] Agr. - Electricity Use	[ZAA] Agr. - Electricity Use
[ZAR] Agr. - Indigenous Electricity	[ZAR] Agr. - Indigenous Electricity	[ZAR] Agr. - Indigenous Electricity
[ZAC] Agr. - Fuel for Heat	[ZAC] Agr. - Fuel for Heat	[ZAC] Agr. - Fuel for Heat
[ZAD] Agr. - Fuel for Electricity	[ZAD] Agr. - Fuel for Electricity	[ZAD] Agr. - Fuel for Electricity
[ZAF] Agr. - Controlled Electricity	[ZAF] Agr. - Controlled Electricity	[ZAF] Agr. - Controlled Electricity
[ZB1] Forced Vlebs	[ZB1] Forced Vlebs	[ZB1] Forced Vlebs
[ZB2] Dry Vlebs	[ZB2] Dry Vlebs	[ZB2] Dry Vlebs
[ZB3] Vlebs2	[ZB3] Vlebs2	[ZB3] Vlebs2
[ZB4] Vlebs1	[ZB4] Vlebs1	[ZB4] Vlebs1
[ZBA] Pulp	[ZBA] Pulp	[ZBA] Pulp
[ZBP] Mechanical Pulp	[ZBP] Mechanical Pulp	[ZBP] Mechanical Pulp
[ZBC] Waste Paper Pulp	[ZBC] Waste Paper Pulp	[ZBC] Waste Paper Pulp
[ZBD] Semi-Chemical Pulp	[ZBD] Semi-Chemical Pulp	[ZBD] Semi-Chemical Pulp
[ZBE] Kraft Pulp	[ZBE] Kraft Pulp	[ZBE] Kraft Pulp
[ZBF] Bleached Pulp	[ZBF] Bleached Pulp	[ZBF] Bleached Pulp
[ZBJ] Non-bleached Pulp 2	[ZBJ] Non-bleached Pulp 2	[ZBJ] Non-bleached Pulp 2
[ZBK] Non-bleached Pulp 1	[ZBK] Non-bleached Pulp 1	[ZBK] Non-bleached Pulp 1
[ZBL] Non-bleached Pulp 2	[ZBL] Non-bleached Pulp 2	[ZBL] Non-bleached Pulp 2

Record Source: Combination

Record: 1 of 1

Form View

Microsoft PowerPoint - [P...]

Japan: Database

Main

Form 7-3

9:10 PM

Enter
• Relationship

Enter

•Relationship between internal energy/services

Relationship between internal/energy and service is defined here.

Stock in Start Year (Area)

Enter

- Stock number of each technology

No.	Region 1	Energy Device	Stock (U Value, L Unit)	Specific Service	Name	V
631,884	Japan	Conventional coal plant	114,076	71.5699997	2890000	COAL Coal
0	Japan	Conventional coal plant	114,076	71.5699997	2890000	COAL Coal
22,565,040	Japan	Conventional coal plant	114,076	71.5699997	2890000	COAL Coal
0	Japan	Conventional coal plant	114,076	71.5699997	2890000	COAL Coal

Even if the main device is same, if removal process is different, stock number should be identified individually

These green parts are entered automatically from "Energy device data"

Stock of each combination of each device and removal rate in start year is defined here.

Maximum Share of Energy Device (Area)

Microsoft Access - [Share_Area - Form]

File Edit View Insert Format Records Tools Window Help

Maximum Share of Energy Device (Area)

No.	Region 1 *	Service *	Energy Device *	Maximum Share *					
				Year1	Value1	Year2	Value2	Year3	Val
1	Japan	[DHP] Hot water (LPG area)	[DRHMP2] Latent Ht recov. water heater (LPG)	1990	0.00%	2000	0.00%	2010	20
2	Japan	[DHP] Hot water (LPG area)	[DRHMP1] Solar thermal water heater (LPG)	1990	5.50%	2000	5.50%	2010	10
3	Japan	[DHP] Hot water (LPG area)	[DRHMP1] Gas water heater (LPG area)	1990	68.03%	2000	68.00%	2010	100
4	Japan	[DHP] Hot water (LPG area)	[DRHMP1] Oil water heater (LPG area)	1990	15.01%	2000	15.00%	2010	100
5	Japan	[DHP] Hot water (LPG area)	[DRHME2] Water heater -CO2 refrigerant(LPG)	1990	0.00%	2000	0.00%	2010	100
6	Japan	[DHP] Hot water (LPG area)	[DRHME1] Electric water heater (LPG area)	1990	10.88%	2000	10.70%	2010	100
7	Japan	[DHP] Hot water (LPG area)	[DCFCP1] Fuel cell for household (LPG area)	1990	0.00%	2000	0.00%	2010	100
8	Japan	[DHP] Hot water (LPG area)	[DRHMS2] Solar system -heat ex. med. (LPG)	1990	0.53%	2000	0.50%	2010	100
9	Japan	[DHP] Hot water (LPG area)	[DRHMS2] Solar system -heat ex. med. (LPG)	1990	67.74%	2000	67.70%	2010	100
10	Japan	[DHP] Hot water (LPG area)	[DRHMP2] Latent Ht recov. water heater (LPG)	1990	0.00%	2000	0.00%	2010	100
11	Japan	[DHP] Hot water (LPG area)	[DRHME2] Water heater -CO2 refrigerant(LPG)	1990	10.78%	2000	10.80%	2010	100
12	Japan	[DOA] Conventional refrigerator	[DCFCP1] Fuel cell for household (LPG area)	1990	0.00%	2000	0.00%	2010	100
13	Japan	[DOA] Kotatsu (table-heat source under)	[DUNCF] Fluorescent of incandescent type	1990	15.15%	2000	15.10%	2010	100
14	Japan	[DOA] Fan	[DUNCF] Fluorescent of incandescent type	1990	6.86%	2000	5.90%	2010	100
15	Japan	[DOA] Electric blanket	[DULFLO1] Conventional fluorescent	1990	0.00%	2000	0.00%	2010	100
16	Japan	[DHP] Hot water (town gas area)	[DHP] Hot water (town gas area)	1990	0.00%	2000	0.00%	2010	100
17	Japan	[DHP] Hot water (town gas area)	[DRHMP2] Latent Ht recovery water heater (T-)	1990	0.00%	2000	0.00%	2010	100
18	Japan	[DHP] Hot water (town gas area)	[DULFLO4] HE Inverter type fluorescent	1990	0.00%	2000	0.00%	2010	100
19	Japan	[DHP] Hot water (town gas area)	[DULFLO3] Inverter type fluorescent	1990	0.00%	2000	0.00%	2010	100
20	Japan	[DHP] Hot water (town gas area)	[DULFLO2] Fluorescent -energy saving stabiliz	1990	0.00%	2000	0.00%	2010	100
21	Japan	[DHP] Hot water (town gas area)	[DULFLO1] Conventional fluorescent	1990	100.10%	2000	100.10%	2010	100
22	Japan	[DHP] Hot water (town gas area)	[DUNCF] Fluorescent of incandescent type	1990	0.10%	2000	0.10%	2010	100
23	Japan	[DHP] Hot water (town gas area)	[DUNCA] Incandescent	1990	100.10%	2000	100.10%	2010	100
24	Japan	[DOA] Conventional refrigerator	[DOARF2] High Eff. Refrigerator (TopRunner)	1990	0.00%	2000	0.00%	2010	100
25	Japan	[DOA] Conventional refrigerator	[DOARF4] High performance refrigerator	1990	0.00%	2000	0.00%	2010	15
26	Japan	[DOA] Conventional refrigerator	[DOARF1] Conventional refrigerator	1990	100.10%	2000	100.10%	2010	100

Record Source: Share_Area

Record: 16 of 27

Form View

Microsoft PowerPoint - [P...]

Japan: Database

Man

Share_Area - Form

9:22 PM

Enter

- Region
- Device
- Maximum share of the energy device
- Corresponding year

Maximum share of energy service in satisfying a services are defined here.



Operating Rate (Area)

No.	Region	Energy Device	Year1	Value1	Year2	Value2	Year3	Value3	Year4	Value4
1	Japan	CEBOM Business power plant	1990	50.00%	2030	50.00%				
2	Japan	CEBOM Business power plant	1990	63.34%	2030	63.34%				
3	Japan	CEBOM Solar power plant	1990	60.00%	2030	60.00%				
4	Japan	COGAS1 Town gas from coke	1990	60.00%	2030	60.00%				
5	Japan	COGAS2 Town gas from LPO	1990	3.50%	2000	3.50%	2010	3.50%		
6	Japan	COGAS3 Town gas from natural gas	1990	77.00%	2030	77.00%				
7	Japan	COOL1 Oil refining (conventional)	1990	49.04%	2030	49.04%				
8	Japan	COOL2 Oil refining (advanced)	1990	60.00%	2030	60.00%				
9	Japan	CEHYDR1 Hydro power plant	1990	47.02%	2000	44.12%	2010	49.00%		
10	Japan	CEHACL1 Nuclear power plant	1990	84.20%	2000	80.00%	2010	80.00%		
11	Japan	CECORP1 Conventional oil plant	1990	60.00%						
12	Japan	CECORP2 Hi performance oil plant	1990	60.00%						
13	Japan	CECORP3 Solar power plant	1990	12.00%	2030	12.00%				
14	Japan	CEVAST1 Waste power plant	1990	57.20%	2030	57.20%				
15	Japan	CEVAND1 Wind power plant	1990	20.00%	2030	20.00%				

Enter

- Region
- Energy device
- Operating rate
- Corresponding year

Operating rate of devices are defined here. If value is not entered, default value is assumed to be 100%.



Improvement at Use Stage

Microsoft Access - [Countermeasure_Menu - Form]

File Edit View Insert Format Records Tools Window Help

Improvement at Use Stage

No.	Code *	Content of Countermeasure	Energy Device *	Reduction Rate *
	C001	Setting temperature to a more appropriate one	[JCEH1C1] Coal heat boiler	5.0%
	C001	Setting temperature to a more appropriate one	[JCEH1C1] Coal heat boiler	5.0%
	C001	Setting temperature to a more appropriate one	[JOTBL01] Oil hot water boiler (h.o.kowgas area)	
	C001	Setting temperature to a more appropriate one	[JOTBLK1] Oil hot water boiler (kero.kowgas area)	
	C001	Setting temperature to a more appropriate one	[JOTBL11] Gas hot water boiler (TGS.kowgas area)	
	C001	Setting temperature to a more appropriate one	[JOTBL12] Coal hot water boiler (down gas area)	
	C001	Setting temperature to a more appropriate one	[JOTBL13] Latent H ₂ recovery water heater (garea)	
	C001	Setting temperature to a more appropriate one	[JOTBL14] Solar water heater (g area)	
	C001	Setting temperature to a more appropriate one	[JOTBLN1] Waste H ₂ recovery water heater (g area)	
	C001	Setting temperature to a more appropriate one	[JCEH1P1] Conventional air conditioner -Cool-	10.0%
	C001	Setting temperature to a more appropriate one	[JCEH1P2] High Eff. Air conditioner (TopRunn-	10.0%
	C001	Setting temperature to a more appropriate one	[JCEH1P4] High perf air conditioner -Cool-	
	C001	Setting temperature to a more appropriate one	[JOFGRP1] Gas heat pump	
	C001	Setting temperature to a more appropriate one	[JOFGRP1] Gas heat pump	10.0%
	C002	Turn off lights during lunch	[JOUOF1] Conventional fluorescent	5.0%
	C002	Turn off lights during lunch	[JOUOF2] Fluorescent Hi-eff (Top-Runner)	5.0%
	C002	Turn off lights during lunch	[JOUOF3] Incandescent	5.0%
	C002	Turn off lights during lunch	[JOUOF4] Fluorescent of incandescent type	5.0%
	F001	1 degree reduction in temp. Setting of air conditioner (heat)	[JDOACN1] Conventional air conditioner -Cool-	3.0%
	F001	1 degree reduction in temp. Setting of air conditioner (heat)	[JDOACN2] High Eff. Air conditioner (TopRunn-	3.0%
	F001	1 degree reduction in temp. Setting of air conditioner (heat)	[JDOACN4] High performance air conditioner -	3.0%
	F002	1 degree increase in temp. Setting of air conditioner (cool)	[JDOAC11] Conventional air conditioner -Cool-	8.0%
	F002	1 degree increase in temp. Setting of air conditioner (cool)	[JDOAC12] High Eff. Air conditioner (TopRunn-	5.0%
	F002	1 degree increase in temp. Setting of air conditioner (cool)	[JDOAC14] High performance air conditioner	5.0%
	F002	1 degree increase in temp. Setting of air conditioner (cool)	[JDOACN1] Conventional air conditioner -Cool-	2.0%
	F002	1 degree increase in temp. Setting of air conditioner (cool)	[JDOACN2] High Eff. Air conditioner (TopRunn-	2.0%
	F002	1 degree increase in temp. Setting of air conditioner (cool)	[JDOACN4] High performance air conditioner	2.0%

Record Source: Countermeasure

Form View

Microsoft PowerPoint - [P...]

Japan - Database

Main

Countermeasure_Menu...

9:25 PM

Enter

- Countermeasure code and name
- Technology to be improved
- Reduction rate (%)

Change in lifestyle and method of use and maintenance is defined here.



Action of Improvement at Use Stage

Microsoft Access - [Countermeasure_Action_Form]

File Edit View Insert Format Records Tools Window Help

Form View

Action of Improvement at Use Stage

No.	Region 1 *	Improvement at Used Stage *	Action Rate*			
			Base	2000	2010	2050
[Area] [AFN] Japan	[Area]	[C001] Setting temperature to a more appropriate one	42.00%	42.00%	100.00%	100.00%
[Area] [AFN] Japan	[Area]	[C002] Setting temperature to a more appropriate one	40.00%	40.00%	100.00%	100.00%
[Area] [AFN] Japan	[Area]	[C003] Turn off lights during lunch	24.00%	24.00%	100.00%	100.00%
[Area] [AFN] Japan	[Area]	[R001] 1 degree reduction in temp. Setting of air conditioner (heat)	24.00%	24.00%	100.00%	100.00%
[Area] [AFN] Japan	[Area]	[R002] 1 degree increase in temp. Setting of air conditioner (cool)	24.00%	24.00%	100.00%	100.00%
[Area] [AFN] Japan	[Area]	[R003] Cut down turning on lights	40.00%	40.00%	100.00%	100.00%
[Area] [AFN] Japan	[Area]	[R004] Reduction in hot water	40.00%	40.00%	100.00%	100.00%
[Area] [AFN] Japan	[Area]	[R005] Use refrigerator efficiently	15.00%	15.00%	100.00%	100.00%
[Area] [AFN] Japan	[Area]	[T001] Removal of any unnecessary luggage prior to driving	17.00%	17.00%	100.00%	100.00%
[Area] [AFN] Japan	[Area]	[T002] Use refrigerator efficiently	27.00%	27.00%	100.00%	100.00%
[Area] [AFN] Japan	[Area]	[T003] Removal of any unnecessary luggage prior to driving	40.00%	40.00%	100.00%	100.00%
[Area] [AFN] Japan	[Area]	[T004] Driving with appropriate pressure	33.00%	33.00%	100.00%	100.00%
[Area] [AFN] Japan	[Area]	[T005] Stop idling				

Record Source: Countermeasure_Action

Form View

Microsoft PowerPoint - [P] Japan - Database

Main

Countermeasure_Acti...

Enter

- Re
- Co
- Ac
- Co

Enter

- Region
- Countermeasure
- Action rate
- Corresponding year

Action rate of “Improvement at use stage” is defined here.



Tax/Regulation Classification

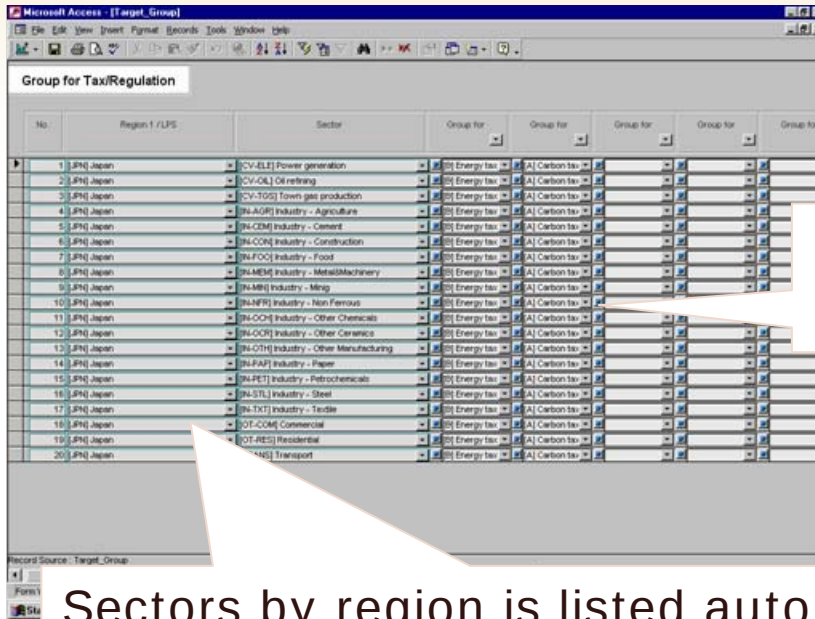
No.	Group Code	Countermeasure Type	Group Name
1	A	CO2	Carbon tax
2	B	CO2	Energy tax

Enter

- Target gas or energy
- Kind of policy (tax or regulation)
- Countermeasure name



Group for Tax/Regulation



No	Region / FLPS	Sector	Group for	Group for	Group for	Group for	Group for
1	JPN Japan	[CV-ELE] Power generation	[E] Energy tax	[A] Carbon tax	[E] Energy tax	[A] Carbon tax	[E] Energy tax
2	JPN Japan	[CV-OL] Oil refining	[E] Energy tax	[A] Carbon tax	[E] Energy tax	[A] Carbon tax	[E] Energy tax
3	JPN Japan	[CV-TOS] Town gas production	[E] Energy tax	[A] Carbon tax	[E] Energy tax	[A] Carbon tax	[E] Energy tax
4	JPN Japan	[RA-AGR] Industry - Agriculture	[E] Energy tax	[A] Carbon tax	[E] Energy tax	[A] Carbon tax	[E] Energy tax
5	JPN Japan	[RA-CEM] Industry - Cement	[E] Energy tax	[A] Carbon tax	[E] Energy tax	[A] Carbon tax	[E] Energy tax
6	JPN Japan	[RA-CON] Industry - Construction	[E] Energy tax	[A] Carbon tax	[E] Energy tax	[A] Carbon tax	[E] Energy tax
7	JPN Japan	[RA-FOO] Industry - Food	[E] Energy tax	[A] Carbon tax	[E] Energy tax	[A] Carbon tax	[E] Energy tax
8	JPN Japan	[RA-MEM] Industry - Metal/Machinery	[E] Energy tax	[A] Carbon tax	[E] Energy tax	[A] Carbon tax	[E] Energy tax
9	JPN Japan	[RA-MIN] Industry - Mining	[E] Energy tax	[A] Carbon tax	[E] Energy tax	[A] Carbon tax	[E] Energy tax
10	JPN Japan	[RA-NFM] Industry - Non Ferrous	[E] Energy tax	[A] Carbon tax	[E] Energy tax	[A] Carbon tax	[E] Energy tax
11	JPN Japan	[RA-OCN] Industry - Other Chemicals	[E] Energy tax	[A] Carbon tax	[E] Energy tax	[A] Carbon tax	[E] Energy tax
12	JPN Japan	[RA-OTH] Industry - Other Chemicals	[E] Energy tax	[A] Carbon tax	[E] Energy tax	[A] Carbon tax	[E] Energy tax
13	JPN Japan	[RA-OTH] Industry - Other Manufacturing	[E] Energy tax	[A] Carbon tax	[E] Energy tax	[A] Carbon tax	[E] Energy tax
14	JPN Japan	[RA-PAP] Industry - Paper	[E] Energy tax	[A] Carbon tax	[E] Energy tax	[A] Carbon tax	[E] Energy tax
15	JPN Japan	[RA-PET] Industry - Petrochemicals	[E] Energy tax	[A] Carbon tax	[E] Energy tax	[A] Carbon tax	[E] Energy tax
16	JPN Japan	[RA-STL] Industry - Steel	[E] Energy tax	[A] Carbon tax	[E] Energy tax	[A] Carbon tax	[E] Energy tax
17	JPN Japan	[RA-TXT] Industry - Textile	[E] Energy tax	[A] Carbon tax	[E] Energy tax	[A] Carbon tax	[E] Energy tax
18	JPN Japan	[ROT-COM] Commercial	[E] Energy tax	[A] Carbon tax	[E] Energy tax	[A] Carbon tax	[E] Energy tax
19	JPN Japan	[ROT-RES] Residential	[E] Energy tax	[A] Carbon tax	[E] Energy tax	[A] Carbon tax	[E] Energy tax
20	JPN Japan	[RNS] Transport	[E] Energy tax	[A] Carbon tax	[E] Energy tax	[A] Carbon tax	[E] Energy tax

Enter

- Tax or regulation in the target sector

Sectors by region is listed automatically



Tax/Regulation

In case of energy tax/regulation, the target energy need be indicated

Enter

- Tax or regulation
- Tax rate
- Corresponding year

Unless checkbox is selected, tax/regulation isn't imposed

Group	Type	Energy	Tax Rate / Regulation							
			Year1	Value1	Year2	Value2	Year3	Value3	Year4	Value4
☒	Carbon tax	CO2 Tax (Yen/kg-C)	1990	0	2000	0	2001	30	2030	30
☒	Energy tax	Energy Tax (Yen/10 ⁹ kcal)	1990	0	2000	0	2001	300	2030	300
☒	Carbon tax	Energy Tax (Yen/10 ⁹ kcal)	1990	0	2000	0	2001	300	2030	300
☒	Energy tax	Energy Tax (Yen/10 ⁹ kcal)	1990	0	2000	0	2001	300	2030	300
☒	Energy tax	Energy Tax (Yen/10 ⁹ kcal)	1990	0	2000	0	2001	300	2030	300
☐	Energy tax	Energy Tax (Yen/10 ⁹ kcal)	1990	0	2000	0	2001	300	2030	300



Subsidy (recruitment/Operation)

Microsoft Access [Subsidy Tech Form]

Subsidy (Recruitment / Operation)

Number	Energy Device *	Combination of Removal Process *	for Recruited / Operation	Year1	Value1	Year2	Value2	Year3
☒	CEOP11 Conventional coal plant	FO_SGR - Hard coal	for recruited cost	1990	5.00%	2030	5.00%	
☒	CEOP11 Conventional gas plant	NRQSS - SGR - Fuel oil	for recruited cost	1990	5.00%	2030	5.00%	
☒	CEOP11 Conventional oil plant	FO_Sco - FGD & SGR - Oil	for recruited cost	1990	5.00%	2030	5.00%	
☒	SOHC11 Without coke wet adjust expt	BMF32 - Wet Desulfurization - Hard coal	for recruited cost	1990	200.00%	2030		
☒	SOHC11 Without coke wet adjust expt	BMF32 - Wet Desulfurization - Hard coal	for recruited cost	1990	200.00%	2030		
☒	SOHC21 Purchased coke	BMF12 - Wet Desulfurization - Hard coal	for operation cost	1990	0.00.00%	2030	0.00.00%	
☒	SOHC21 Purchased coke	NOR1 - Without Removal Technologies	for recruited cost					
☒	SOHC21 Purchased coke	BMF13 - Wet Desulfurization - Hard coal	for recruited cost					
	GSFH11 Conveyer-igniter-sintering furnace							
	GSFH12 Auto igniter-sintering furnace							
	GSNF11 Sintering furnace							
	GSNF21 Snt tm. - Mainly waste heat rcv.							
	GSNF21 Snt tm. - Cooler waste heat rcv.							
	GSNF41 Snt tm. - Mainly Cooler waste heat rcv.							
	MLQ1 Without waste plastic							

Enter

- Technology to be subsidized
- Recruitment or operation
- Subsidy rate
- Corresponding year

Unless checkbox is selected, subsidy isn't introduced

Subsidy for devices is defined here



Subsidy (Removal Process)

Microsoft Access - [Subsidy_Rev - Form]

Subsidy (Removal Process)

Number	Energy Device *	Combination of Removal Process 1 *	Combination of Removal Process 2 *	Subsidy Rate *			
				Year1	Value1	Year2	Value2
☒	SGCH1) Without coke wet adj.	NON	CHMF32	1999	300.00%	2000	300.00%
☒	SGCH2) Coke wet adjustment	NON	CHMF32	1999	300.00%	2000	300.00%
☒	SGCF2) Purchased coke	NON	CHMF32	1999	300.00%	2000	300.00%
☒	STBF1) Blast furnace	NON	CHMF31	1999	300.00%	2000	300.00%
☒	STBF2) Blast furnace + HET	NON	CHMF31	1999	300.00%	2000	300.00%
☒	STBF3) Blast furnace + 4 Stages	NON	CHMF31	1999	300.00%	2000	300.00%
☒	STBF4) Blast furnace + 4 Stages	NON	CHMF31	1999	300.00%	2000	300.00%
☒	STBF5) LDO for steel industry	NON	CHMF31	1999	300.00%	2000	300.00%
☒	STBF6) LDO for other industry	NON	CHMF31	1999	300.00%	2000	300.00%
☒	STOF1) LDO	NON	CHMF31	1999	300.00%	2000	300.00%
☒	STOF2) LDO + Cw. LDO recy.	NON	CHMF31	1999	300.00%	2000	300.00%
☒	STOF3) LDO + Closed LDO recy.	NON	CHMF31	1999	300.00%	2000	300.00%
☒	STOF4) LDO + Cw. LDO rev.	NON	CHMF31	1999	300.00%	2000	300.00%
☒	STOF5) LDO + Closed LDO rev.	NON	CHMF31	1999	300.00%	2000	300.00%

Unless checkbox is selected, subsidy isn't introduced

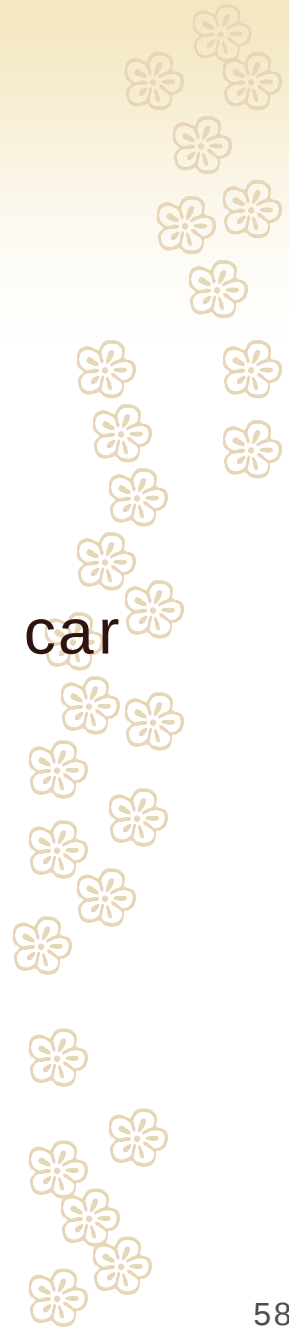
Enter

- Technology to be subsidized
- Subsidy rate
- Corresponding year

subsidy for removal process is defined here

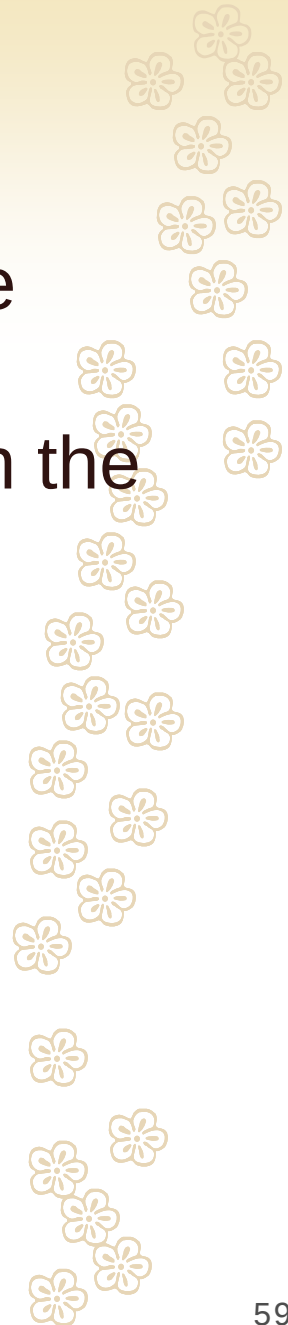
[3] Exercise 1

Estimate future emission from passenger car

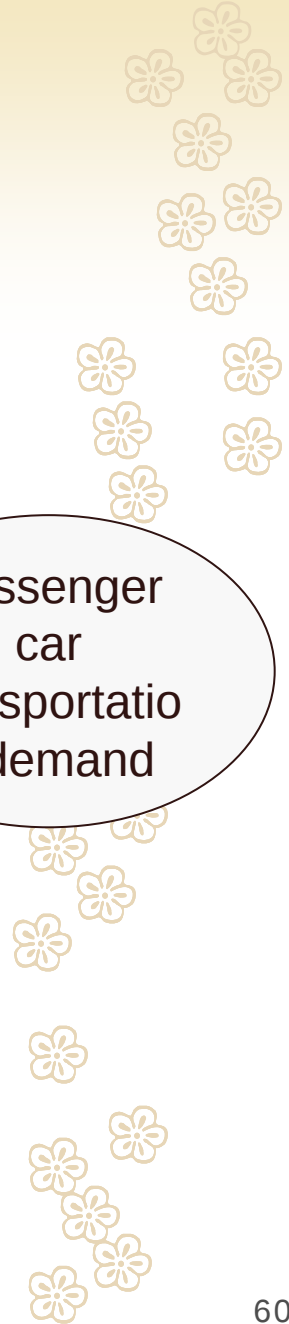
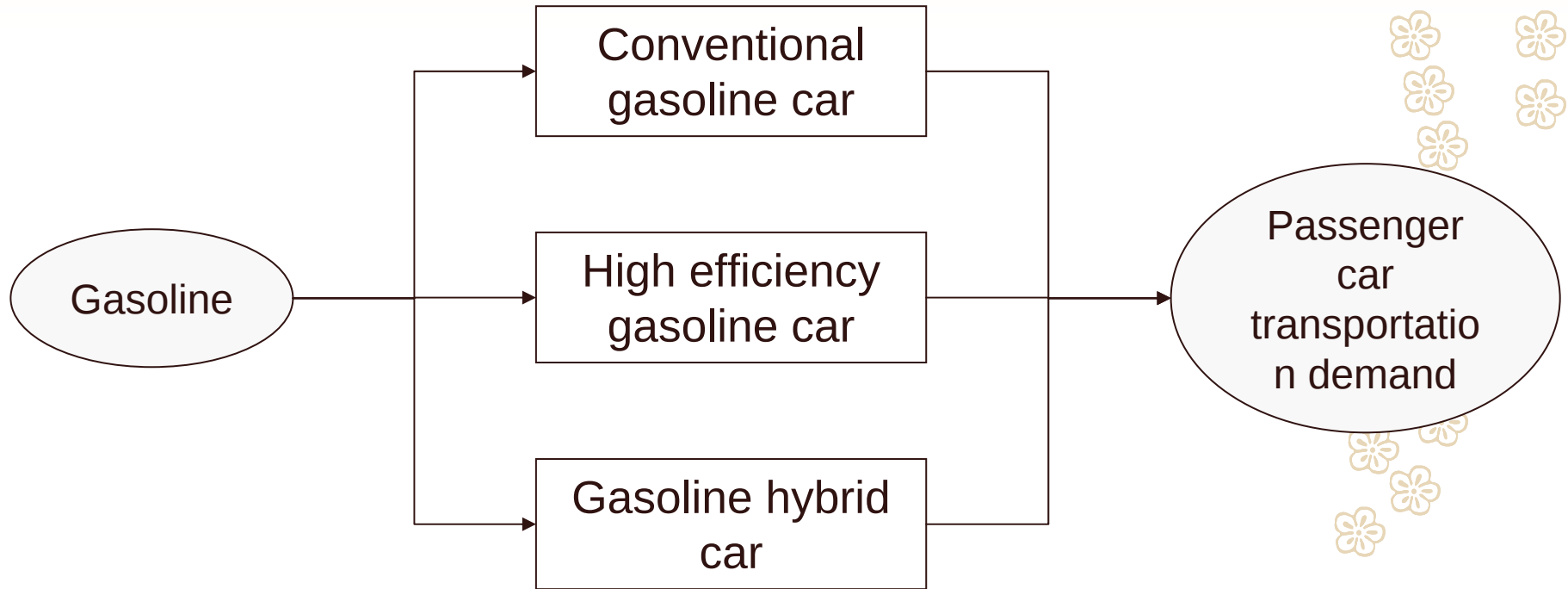


Purpose

1. Learn how to develop data for AIM/Enduse
2. Learn how to estimate future emission with the following countermeasures.
 - Countermeasure at use stage
 - Carbon tax
 - Subsidy



Assumption



Assumption

A) Transportation demand of passenger car

		2000	2010	2030
TPRC	Passenger Car demand (10^3 km)	120,000,000	200,000,000	300,000,000

B) Stock number of conventional gasoline car in 2000

Stock number of conventional gasoline car in 2000	6,000,000
---	-----------



Assumption

C)Energy devices specifications

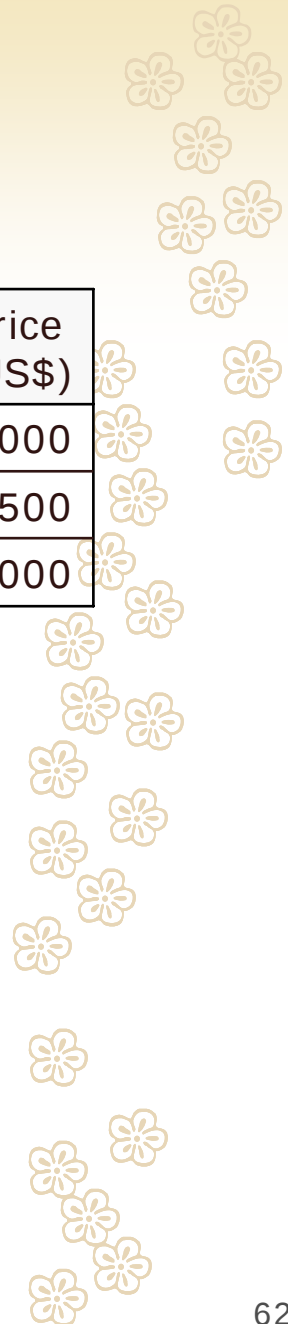
		Fuel efficiency (km/kg)	Life time	Price (US\$)
TCG1	Conventional gasoline car	18	10	1,000
TCG2	High efficiency gasoline car	24	10	1,500
TCG3	Gasoline Hybrid car	36	10	2,000

D)Average usage characteristics per car

	2000 – 2030
Average number of persons per car	2
Average km travel per car per year	10,000

E)Energy specification

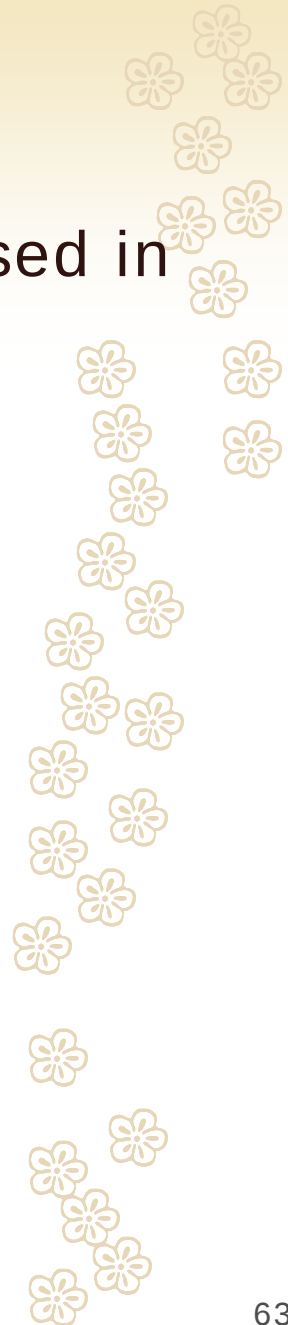
		Price (\$/kg)
EL_OLG	Gasoline	0.4



Step1: Data entry

Step 1-1. Enter parameters in “Parameters used in computation”

- Start year = 2000
- End year = 2020
- Discount rate = 20%
- Unit price = US\$
- Unit of Energy = GJ
- Unit of CO2 = kg-C
- Unit of SO2 = kg-SO2
- Unit of NOx = kg-NO2



Step1: Data entry

Step 1-2. Enter country code and name in “Region Classification1”

- Enter your country code and name

Step 1-3. Enter sector code and name in “Sector Classification”

- Enter “TP-ROD” as sector code and
“Transportation – Road” as sector name



Step1: Data entry

Step 1-4. Enter service code, name and unit in “Service Classification”

•Refer assumption A)

Step 1-5. Enter service demand in “Service Demand (AS)”

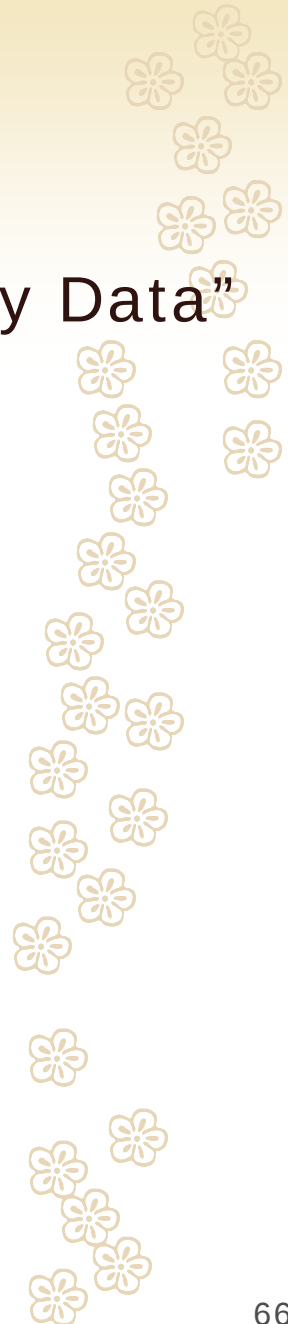
•Refer assumption A)



Step1: Data entry

Step 1-6. Enter energy specification in “Energy Data”

- Energy Price in assumption E) needs to be converted to match the unit in “Parameters used in computation”. Refer Appendix F,G of AIM/Enduse Manual and calculate it.
- Find CO2 emission factor and SO2 emission factor from Appendix F of AIM/Enduse Manual



Step1: Data entry

Step 1-6. Enter energy specification in “Energy Data”

Energy Price

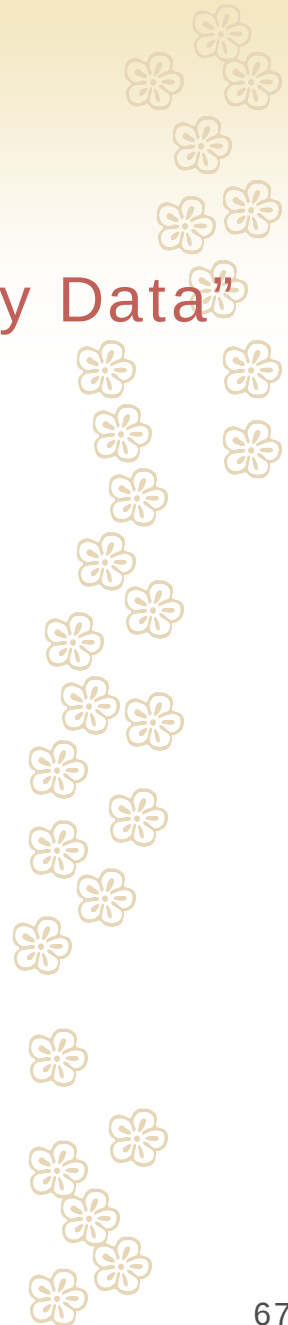
$$\begin{aligned} &= 0.4 \$/\text{kg} * 1000 \\ &\quad / (1.07 \text{toe}/\text{t} * 41.868 \text{ GJ}/\text{toe}) \\ &= 400 \text{ \$}/\text{t} / (44.80 \text{ GJ}/\text{t}) \\ &= 8.93 \text{ \$}/\text{GJ} \end{aligned}$$

CO2 emission factor

$$= 18.9 \text{ kg-C}/\text{GJ}$$

SO2 emission factor

$$= 0.0038 \text{ kg-SO}_2/\text{GJ}$$



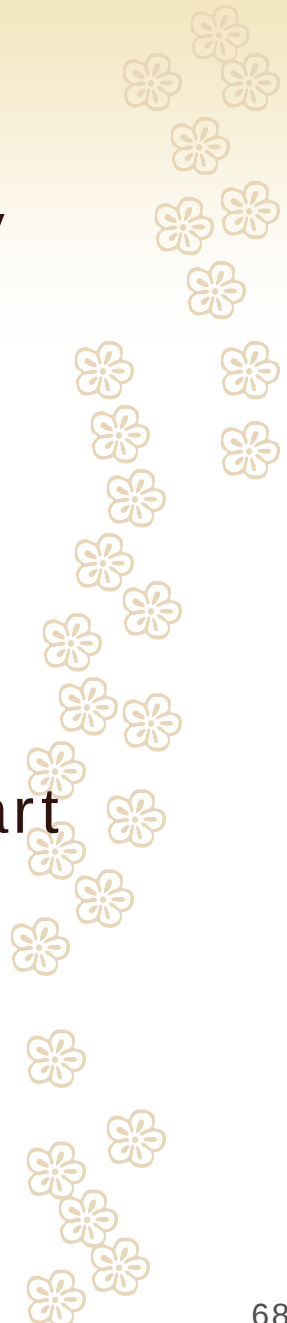
Step1: Data entry

Step 1-7. Estimate the specification of energy device in “Energy Device Data”

- Specific energy consumption and specific service output need to be calculated from assumption C), D) and Appendix F of AIM/Enduse Manual

Step 1-8. Enter stock number in “Stock in Start Year”

- Refer assumption B)



Step1: Data entry

Step 1-7. Estimate the specification of energy device in “Energy Device Data”

Conventional gasoline car

Specific Service Output

= Average km traveled per car per year

* Average number of persons per car

= $2 * 10,000 / 10^3$

= 20 p-km/Unit

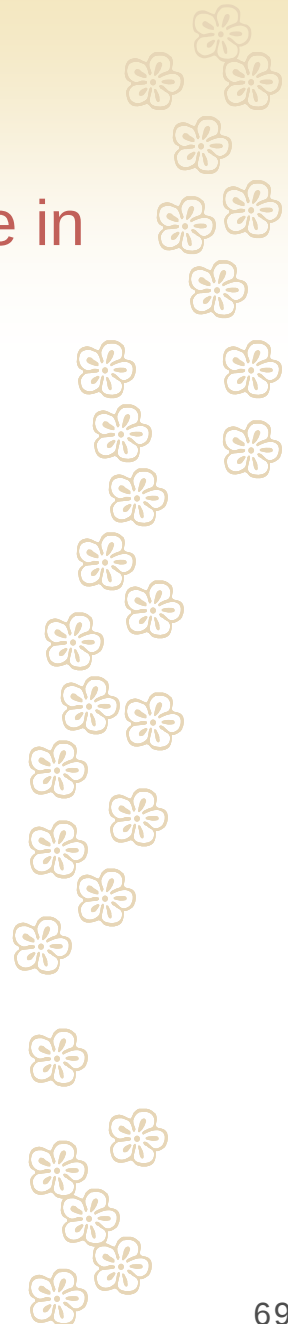
Specific Energy Consumption

= Average km traveled per car per year / Fuel efficiency * calorific value

= $(10,000 \text{ km/Unit}) / (18 \text{ km/kg})$

* $(1.07 \text{ toe/t}) / 10^3 * 41.868 \text{ GJ/toe}$

= 24.9 GJ



Step1: Data entry

Step 1-7. Estimate the specification of energy device in “Energy Device Data”

High efficiency gasoline car

Specific Service Output

= Average km traveled per car per year

* Average number of persons per car

= $2 * 10,000 / 10^3$

= 20 p-km/Unit

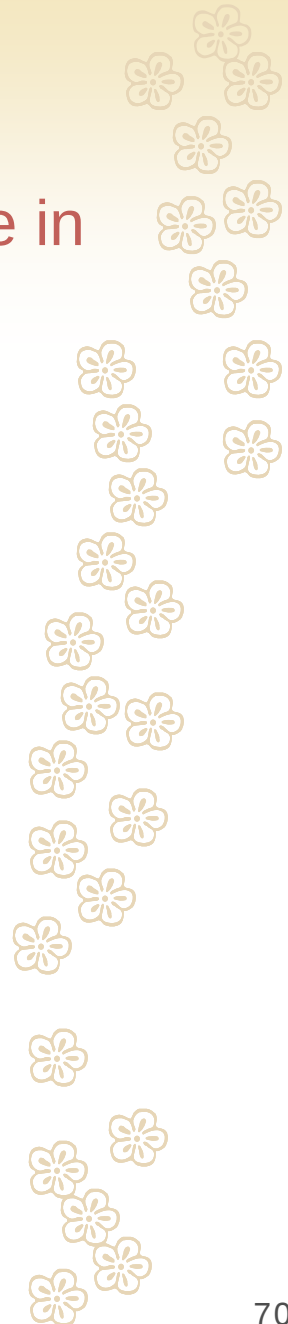
Specific Energy Consumption

= Average km traveled per car per year / Fuel efficiency * calorific value

= $(10,000 \text{ km/Unit}) / (24 \text{ km/kg})$

$*(1.07 \text{ toe/t}) / 10^3 * 41.868 \text{ GJ/toe}$

= 18.7 GJ



Step1: Data entry

Step 1-7. Estimate the specification of energy device in “Energy Device Data”

Gasoline hyrid car

Specific Service Output

= Average km traveled per car per year

* Average number of persons per car

= $2 * 10,000 / 10^3$

= 20 p-km/Unit

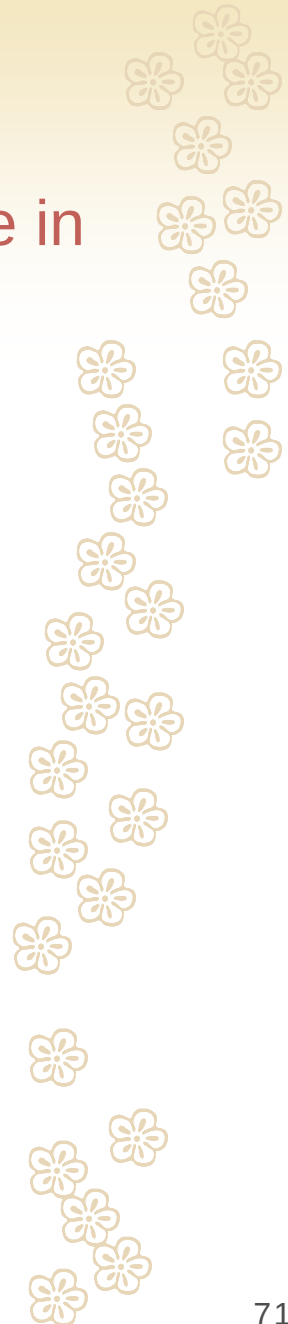
Specific Energy Consumption

= Average km traveled per car per year / Fuel efficiency * calorific value

= $(10,000 \text{ km/Unit}) / (36 \text{ km/kg})$

* $(1.07 \text{ toe/t}) / 10^3 * 41.868 \text{ GJ/toe}$

= 12.4GJ



Step2: Simulation of reference case

The screenshot shows the AIM/Enduse Database System ver 2.0 interface. The main window is divided into several sections:

- Control parameters:**
 - Parameters used in Computation
 - Region:
 - Region Classification 1
 - Region Classification 2
 - Allocation Index Type
 - Large Point Source
 - Sector:
 - Sector Classification
 - Service:
 - Service Classification
 - Service Demand (AS)
 - Service Demand (LPS)
 - Service Loss (AS)
 - Service Loss (LPS)
 - Energy:
 - Energy Data
 - Change in Energy Data
 - Technology:
 - Energy Device Data (Tabular/Columnar)
 - Change in Energy Device
 - Removal Process
- Combination:**
 - Combination of Removal Processes
 - Combination of Energy Dvc. and Removal Processes
 - Relationship between Internal Energy
- Stock:**
 - Stock in Start Year (AS) (Tabular/Columnar)
 - Stock in Start Year (LPS) (Tabular/Columnar)
- Share:**
 - Maximum Share (AS)
 - Maximum Share (LPS)
- Performance:**
 - Operating Rate (AS)
 - Operating Rate (LPS)
- Countermeasure:**
 - Improvement at Use Stage
 - Action of improvement at Use Stage
 - Tax / Regulation Class
 - Group for Tax / Regulation
 - Tax / Regulation
 - Subsidy (Recruitment / Operation)
 - Subsidy (Removal Process)

Four callout boxes provide instructions for the simulation process:

- Step 2-1. Click "Export data to GAMS"**: Points to the "Export data to GAMS" button.
- Step 2-2. Execute AIM_CMB program**: Points to the "AIM_CMB program" section.
- Step 2-3. Click "Conversion Data from GAMS"**: Points to the "Converting Data from GAMS" button.
- Step 2-4. Click "Display simulation result"**: Points to the "Pivot table and graph" section.

Step3: Simulation of Improvement at use stage

Step 3-1. Enter countermeasure at use stage in
“Improvement at use stage”

Step 3-2. Enter action rate in “Action of
improvement at use stage”

Step 3-3. Calculate future emission

		Fuel saving	Action Rate		
			2000	2010	2030
T01	Driving with appropriate tire pressure	3.8%	10%	50%	100%
T02	Stop idling	3.0%	10%	50%	100%

Step4: Simulation of carbon tax

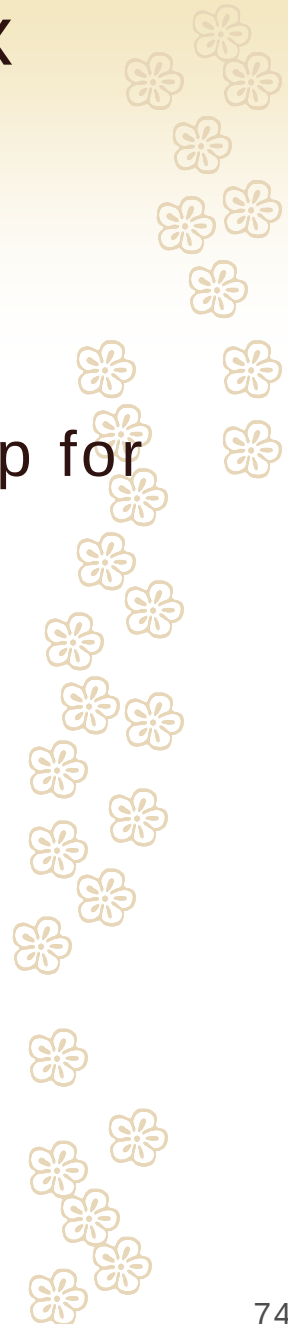
Step 4-1. Enter countermeasure type in
“Tax/Regulation Classification”

Step 4-2. Select carbon tax in the list of group for
CO2 in “Group for Tax/Regulation
Measure”

Step 4-3. Enter tax rate in “Tax/Regulation”

Step 4-4. Calculate future emission

	2000-2002	2003-2020
Carbon Tax	Without Tax	1.0US\$/kgC

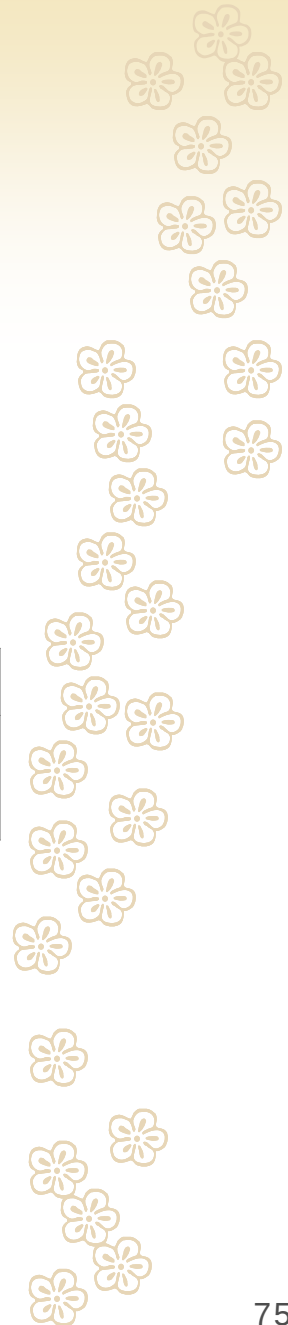


Step5: Simulation of subsidy

Step 5-1. Enter subsidy rate in “Subsidy (Recruitment/Operation)”

Step 5-2. Calculate future emission

	2000-2002	2003-2020
Susidy	Without subsidy	30% subsidy for recruitment of gasoline hybrid car

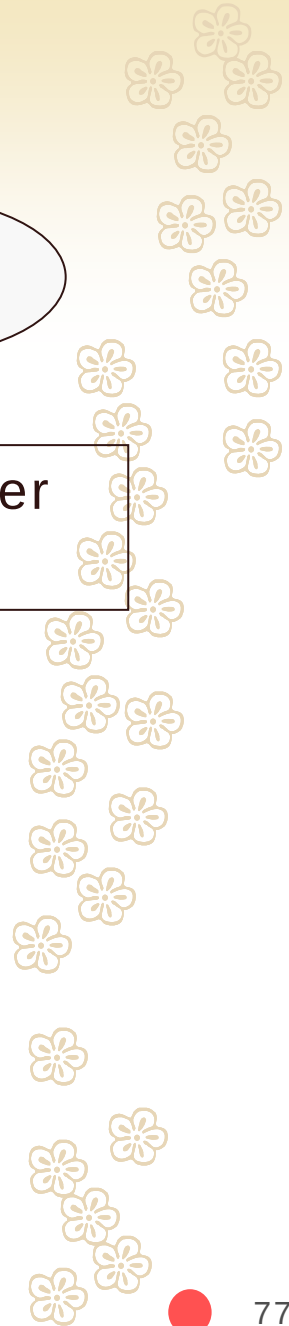
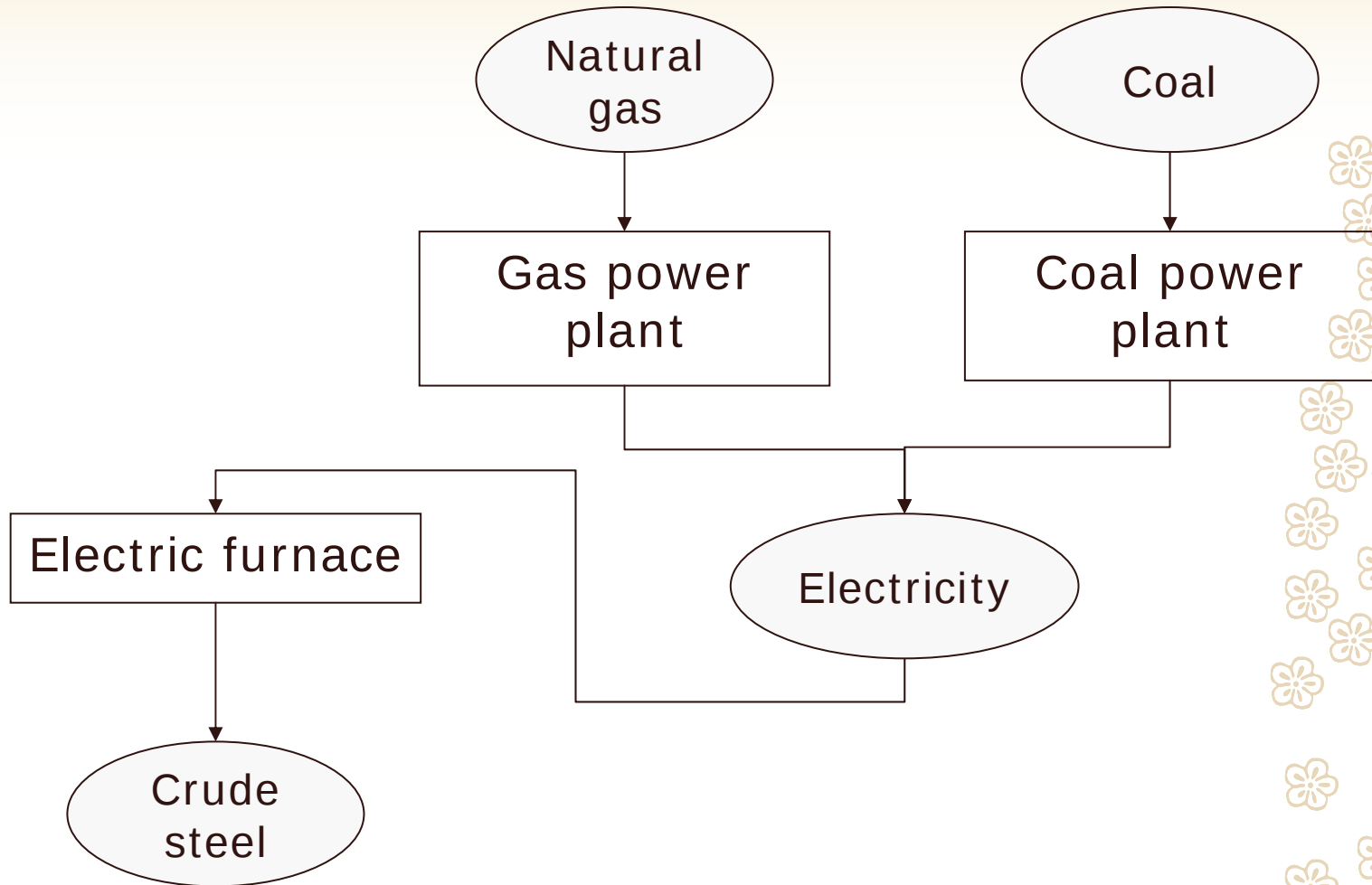


[4] Exercise 2

Estimate future emission from power generation



Assumption



Purpose

1. Learn how to combine energy device with removal process
2. Learn how to estimate future emission with the following countermeasures.
 - SO₂ emission regulation
 - CO₂ emission regulation



Assumption

A) Crude steel production demand

		2000	2010	2030
STL	Crude steel production (t)	10,000,000	15,000,000	30,000000

B) Energy device specifications

		Capacity	Price	Energy efficiency	Life time
ELSTL	Electric furnace	50,000 t/year	25 Million US\$	250 Million kWh/yr.	40
PWCL	Coal power plant	1,000,000 kW	3,000 Million US\$	40%	40
PWNG	Gas power plant	1,000,000 kW	3,000 Million US\$	50%	40

Assumption

C) Stock quantity and operating rate of energy device

		Stock	Operating rate
PWCL	Coal power plant without desulfurization	1,000,000kW	57.1%
PWCL	Coal power plant with desulfurization	0	57.1%
PWNG	Gas power plant	0	57.1%
ELSTL	Electric furnace	20 (500,000t/year scale)	100%

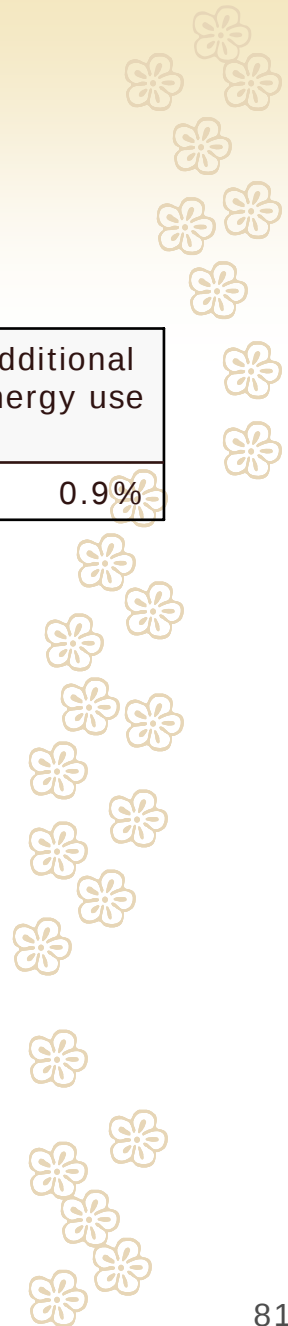
D) Energy specifications

		Price
EN_COL	Coal	0.05\$/kg
EN_GNG	Natural gas	0.2\$/Nm ³

Assumption

E) Removal process

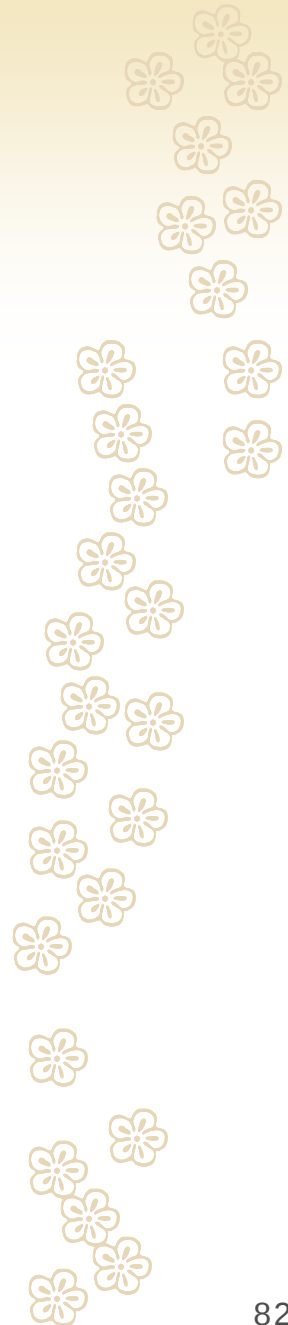
		Stage of process	Removal rate(%)	Initial cost (\$/GJ)	Operating cost (\$/GJ)	Additional energy use
SHWF3	FDG Hard coal	Post-combustion	95%	3.53	0.19	0.9%



Step1: Data entry

Step 1-1. Enter data in “Parameters used in computation”

- Start year = 2000
- End year = 2020
- Discount rate = 20%
- Unit price = US\$
- Unit of Energy = GJ
- Unit of CO₂ = kg-C
- Unit of SO₂ = kg-SO₂
- Unit of NO_x = kg-NO₂



Step1: Data entry

Step 1-2. Enter country code and name in “Region Classification1”

- Enter your country code and name

Step 1-3. Enter sector code and name in “Sector Classification”

- Enter “IN-STL” as sector code and “Industry - Steel” as sector name
- Enter “CV-ELE” as sector code and “Power generation” as sector name



Step1: Data entry

Step 1-4. Enter service code, name and unit in “Service Classification”

- Refer assumption A)
- Add Electricity (Code: EN_ELE, Unit: GJ)

Step 1-5. Enter service demand in “Service Demand (AS)”

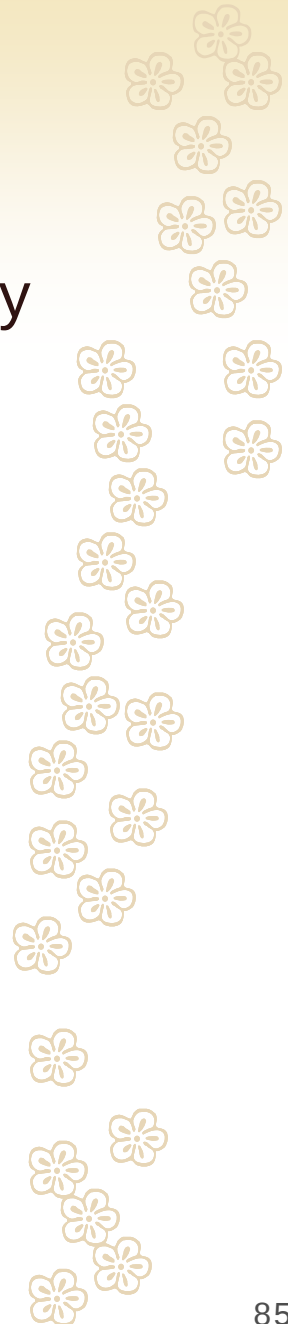
- Refer Assumption A)
- Service demand of EN_ELE is calculated endogenously, so Enter 1 as the service demand of EN_ELE



Step1: Data entry

Step 1-6. Enter energy specification in “Energy Data”

- Energy Price in assumption D) needs to be converted to match the unit which you entered in “Parameters used in computation”. Refer Appendix F,G of AIM/Enduse Manual and calculate it.
- Find CO2 emission factor and SO2 emission factor from Appendix F of AIM/Enduse Manual



Step1: Data entry

Step 1-6. Enter energy specification in “Energy Data”

Coal

Energy Price

$$= 0.05 \text{ \$/kg} * 1000 / (0.6 \text{ toe/t} * 41.868 \text{ GJ/toe})$$

$$= 50 \text{ \$/t} / (25.12 \text{ GJ/t})$$

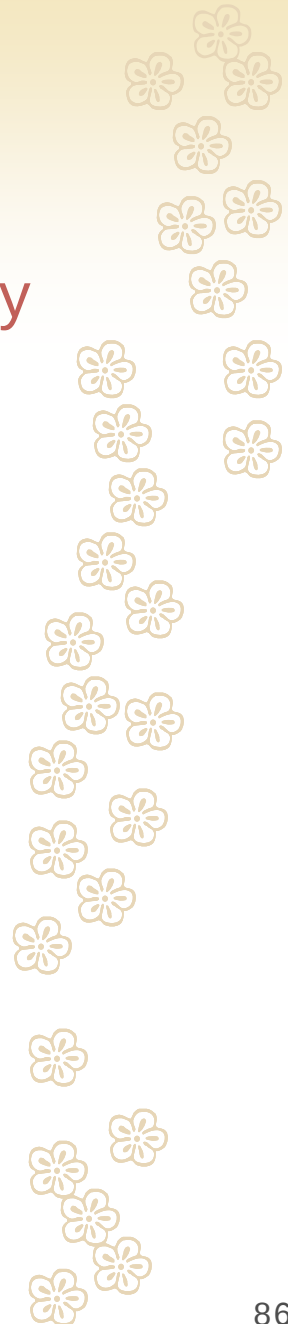
$$= 2.0 \text{ \$/GJ}$$

CO2 emission factor

$$= 25.8 \text{ kg-C/GJ}$$

SO2 emission factor

$$= 0.333 \text{ kg-SO2/GJ}$$



Step1: Data entry

Step 1-6. Enter energy specification in “Energy Data”

Natural gas

Energy Price

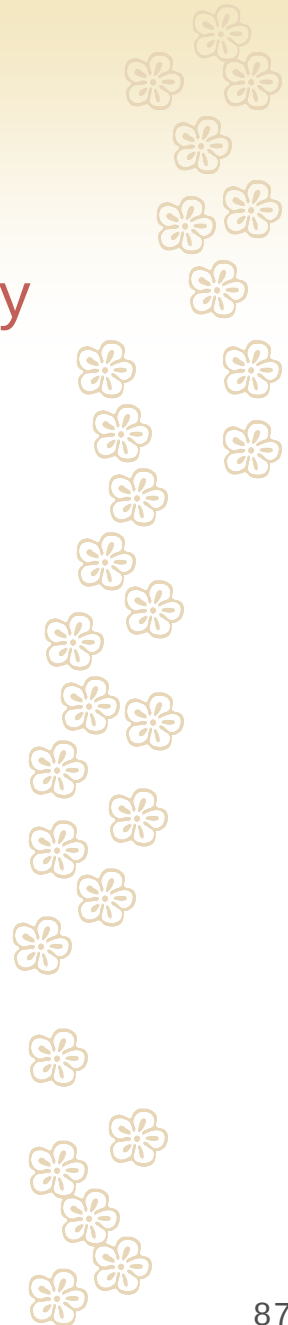
$$\begin{aligned} &= 0.2 \text{ \$/Nm}^3 * 1,000 \\ &\quad / (0.901 \text{ toe} / 1,000\text{Nm}^3 * 41.868 \text{ GJ/toe}) \\ &= 200 \text{ \$/1,000Nm}^3 / (37.72 \text{ GJ} / 1,000\text{Nm}^3) \\ &= 5.3 \text{ \$/GJ} \end{aligned}$$

CO2 emission factor

$$= 15.3 \text{ kg-C/GJ}$$

SO2 emission factor

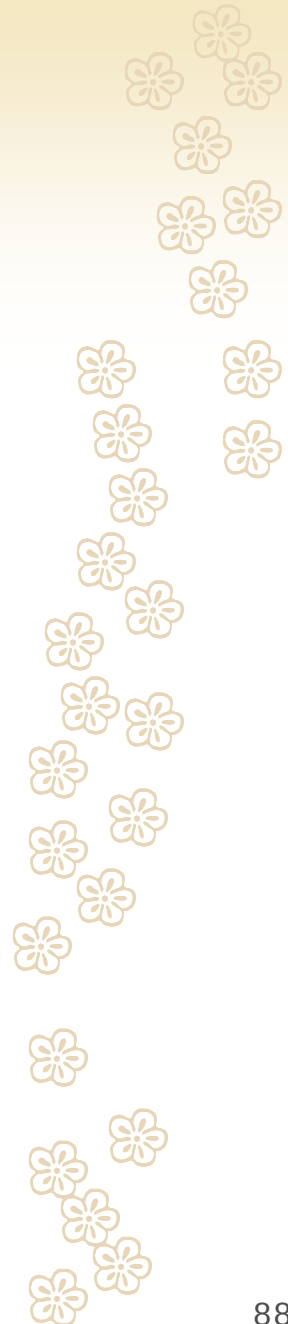
$$= 0.001 \text{ kg-SO}_2\text{/GJ}$$



Step1: Data entry

Step 1-7. Estimate the specification of energy device in “Energy Device Data”

- Specific energy consumption and specific service output need to be calculated from assumption B), C) and Appendix G of AIM/Enduse Manual
- Enter “1kW” as unit of coal power plant and gas power plant
- Enter “500kt” as unit of electric furnace



Step1: Data entry

Step 1-7. Estimate the specification of energy device in “Energy Device Data”

Coal power generation

Unit : 1kW

Price: 3,000M US\$/ (1,000,000 / 1)

= 3,000US\$/Unit

Specific Service Output

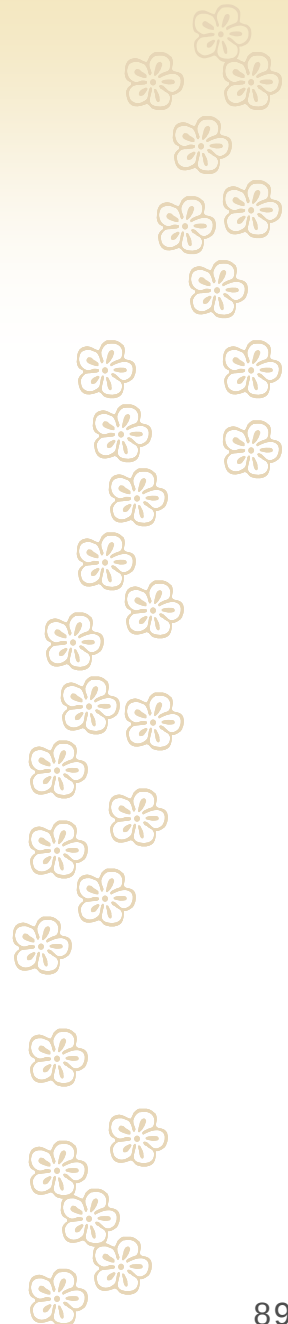
= 1kW * 24(h) * 365 (days) * 3.6
MJ/kWh/1,000

=31.54 GJ

Specific Energy Consumption

=31.54 / 40%

=78.84 GJ



Step1: Data entry

Step 1-7. Estimate the specification of energy device in “Energy Device Data”

Gas power generation

Unit : 1kW

Price: 3,000M US\$/ (1,000,000 / 1) =
3,000US\$/Unit

Specific Service Output

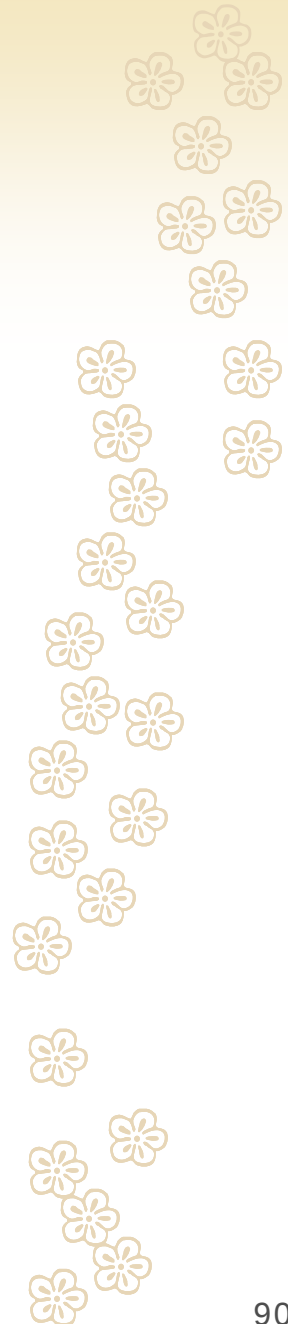
= 1kW * 24(h) * 365 (days) * 3.6
MJ/kWh/1,000

=31.54 GJ

Specific Energy Consumption

=31.54 / 50%

=63.07 GJ



Step1: Data entry

Step 1-7. Estimate the specification of energy device in “Energy Device Data”

Electric furnace

Unit : 500kt

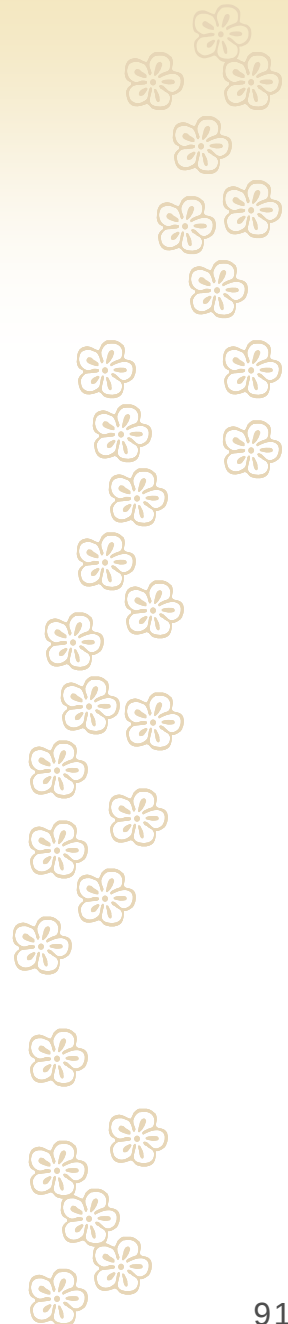
Price: 25,000,000 US\$

Specific Service Output: 500,000 t

Specific Energy Consumption

= 250,000,000 kWh * 3.6 MJ/kWh / 1,000

= 900,000 GJ



Step1: Data entry

Step 1-8. Enter removal process data in “removal process”

- Refer assumption E)

Step 1-9. Enter combination of removal process in “combination of removal process”

- Select “SHWF3” as post combustion and enter “SHWF3” as code of combination of removal processes



Step1: Data entry

Step 1-10. Enter combination of energy device and removal process in “combination of Energy Dvc. and removal processes”

- Set combination of coal power plant and removal process

Step 1-11. Enter relationship of internal energy in “Relationship between Internal Energy/Service”

- Select “EN_ELE” as both internal energy and internal service



Step1: Data entry

Step 1-12. Enter stock number in “Stock in Start Year”

•Refer assumption C)

Step 1-13. Enter operating rate in “Operating rate”

•Refer Assumption C)



Step2: Simulation of reference case

Step 2-1. Click "Export data to GAMS"

Step 2-2. Execute AIM_CMB program

Step 2-3. Click "Conversion Data from GAMS"

Step 2-4. Click "Display simulation result"

The screenshot shows the AIM/Enduse Database System ver 2.1.1 interface. The main window is titled "AIM/Enduse Database System ver 2.1.1". It features a left sidebar with "Control parameters" including Region, Sector, Service, Energy, and Technology. The main area is divided into several sections: "Combination" (with links for Removal Processes, Energy Dvc. and Removal Processes, and Internal Energy), "Stock" (with links for Stock in Start Year (AS) and (LPS)), "Share" (with links for Maximum Share (AS) and (LPS)), "Performance" (with links for Operating Rate (AS) and (LPS)), and "Countermeasure" (with links for Improvement at Use Stage, Action of improvement at Use Stage, Tax / Regulation Class, Group for Tax / Regulation, Tax / Regulation, Subsidy (Recruitment / Operation), and Subsidy (Removal Process)). On the right, there is a "Simulation Results" section with a "Pivot table and graph" and an "Export Result for GIS" button. The bottom status bar shows "Form View", "Microsoft PowerPoint - [Pr...", "Japan : Database", "Main", and the time "8:35 PM".

Step3: Simulation of SO2 regulation

Step 3-1. Enter countermeasure type in
“Tax/Regulation Classification”

Step 3-2. Select SO2 regulation in power
generation sector in “Group for
Tax/Regulation Measure”

Step 3-3. Enter maximum limit in “Tax/Regulation”

Step 3-4. Calculate future emission

	2000-2030
Regulation	20,000,000kg-SO2



Step4: Simulation of CO2 regulation

Step 4-1. Enter countermeasure type in
“Tax/Regulation Classification”

Step 4-2. Select CO2 regulation in power
generation sector in “Group for
Tax/Regulation Measure”

Step 4-3. Enter maximum limit in “Tax/Regulation”

Step 4-4. Calculate future emission

	2000-2030
Regulation	5,000,000,000kg-C

