AIM/Enduse Model

2006 AIM Training Workshop
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Tutors of AIM/Enduse Model

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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	*Coffee Break*
	14:50-16:20	[2] How to operate AIM/Enduse Model (Cont.)
	16:20-16:40	*Coffee Break*
	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 *AIM/Enduse Model or Energy Snapshot Tool or others*
10/19 (Thr.)	14:40-16:40	[8] Self-learning *AIM/Enduse Model or Energy Snapshot Tool or others*

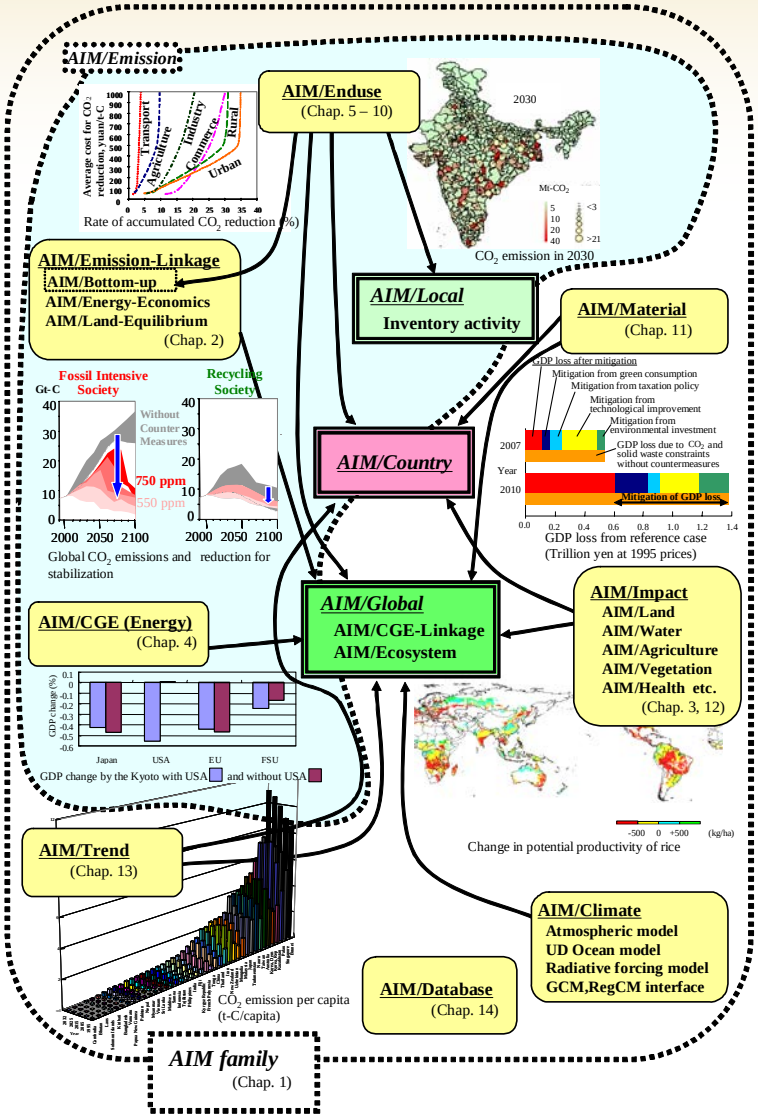
Schedule is flexible!

[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

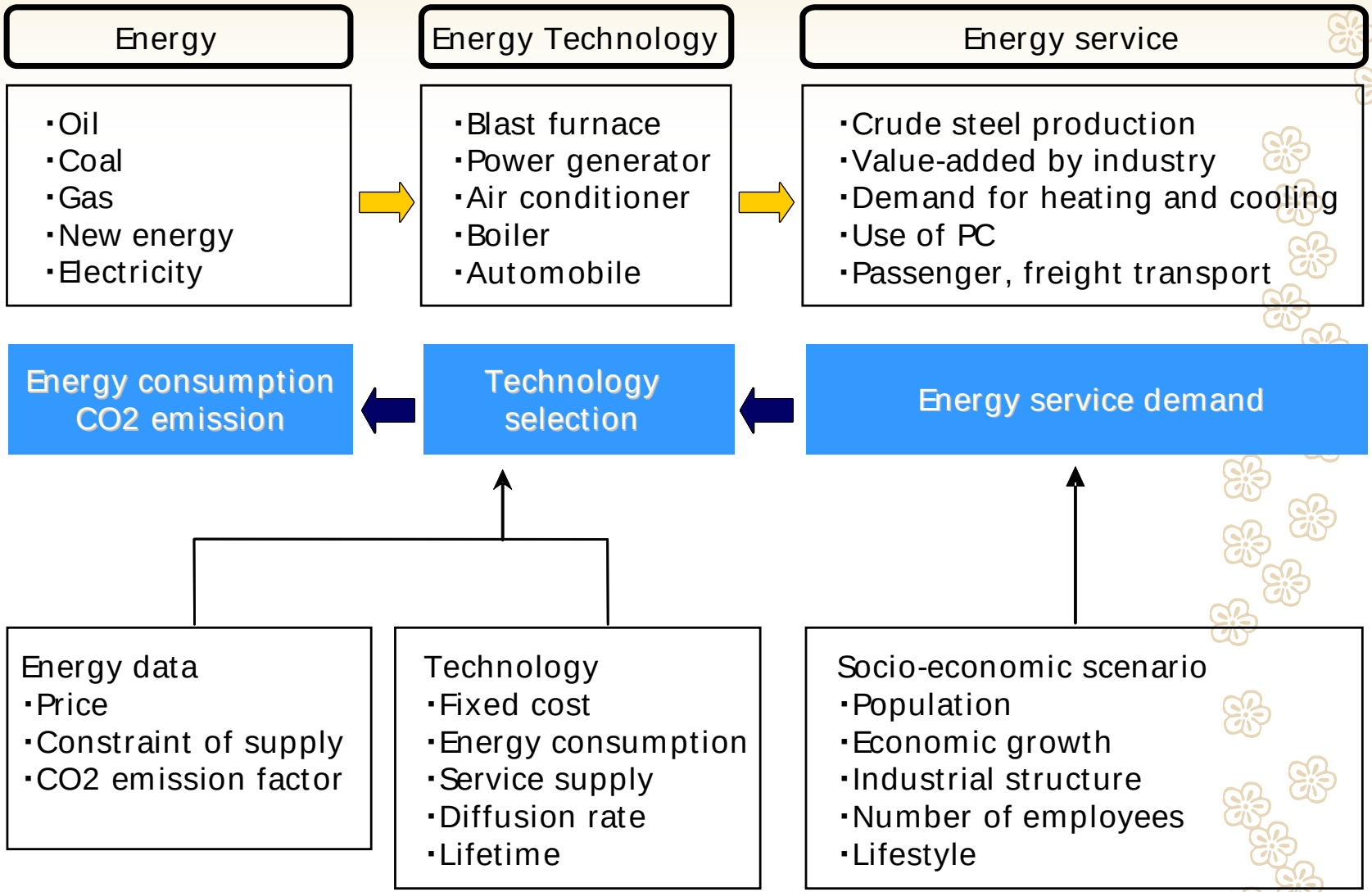
Overview of AIM models



AIM/Enduse model is

- Emission model, Climate model
- Country model, Global model
- Bottom-up model, Top-down model

Structure of AIM/Enduse Model



Formulation of technology selection

1) Objective function

Minimize Total Cost (TC)

TC= Annualized initial cost

+ Operating and management cost

+ Energy cost

+ Payment for energy tax

+ Payment for emission tax

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

Formulation of technology selection

2) Constraints

- *Allowable maximum limit of gas emission*

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

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

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

- *Service demand*

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

$D(j)$: *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*

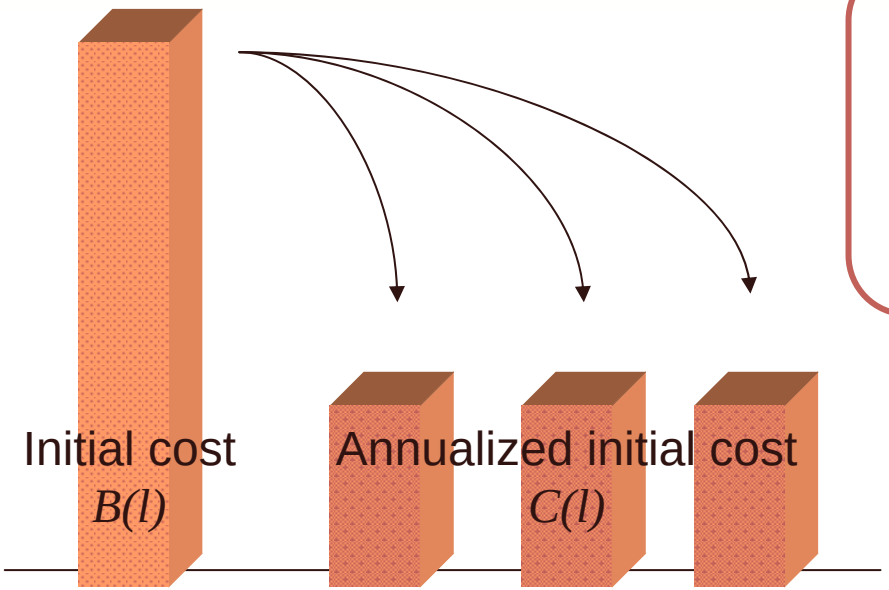
$$E(k,l) \cdot X(l) \le \hat{E}(k)$$

$E(k,l)$: *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

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

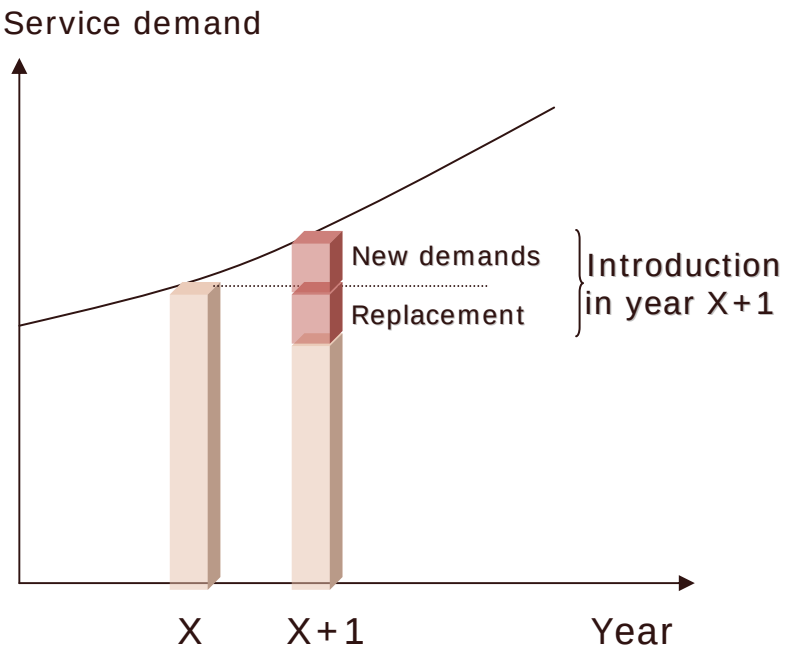
- Payback time period method

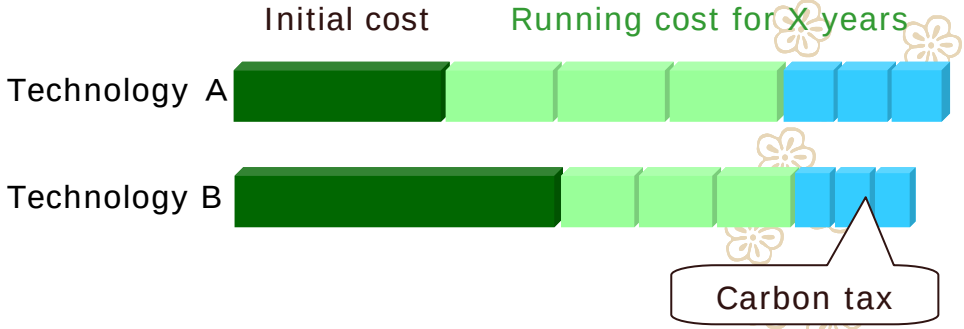
$$C(l) = \frac{B(l)}{\min(T, L)}$$

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

Examples of technology selection

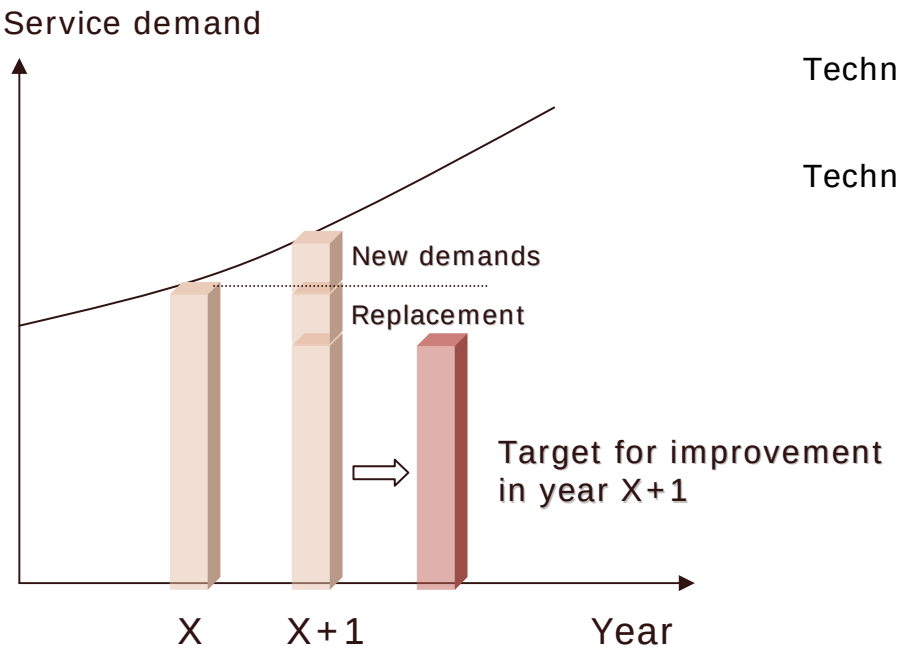
1) Recruitment of new technology

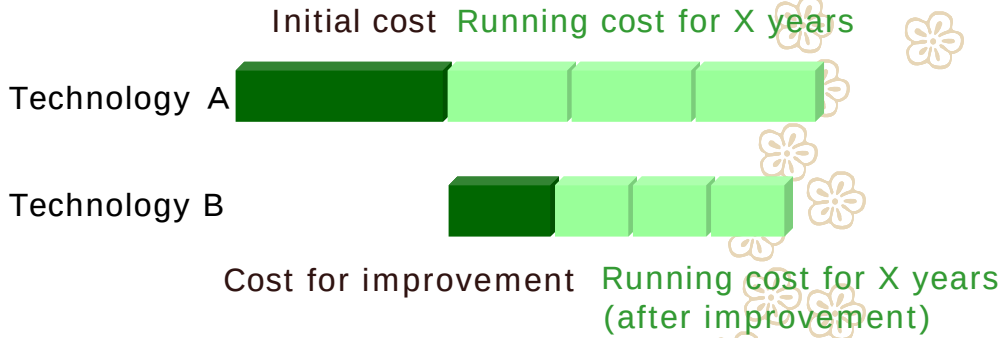




Examples of technology selection

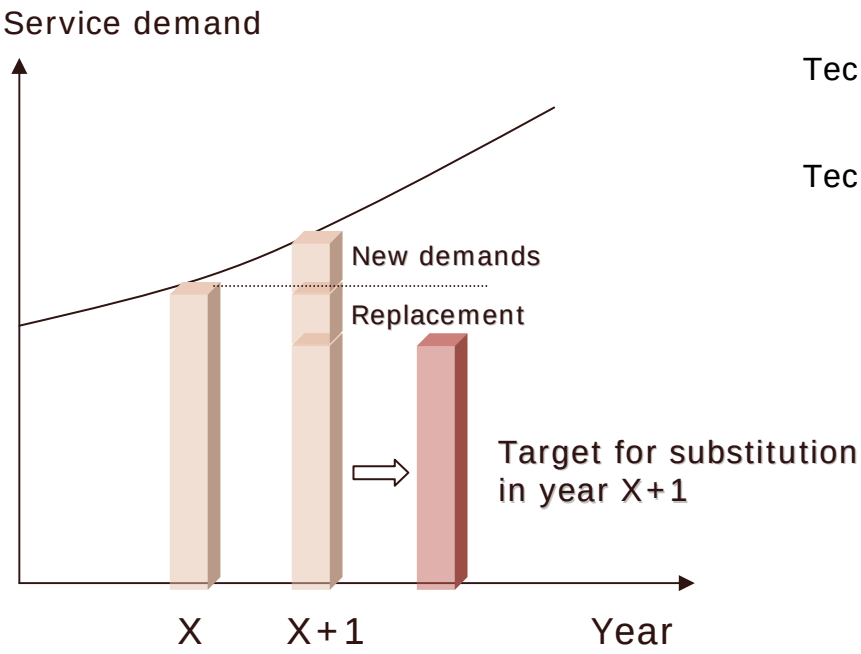
2) Improvement of existing technology

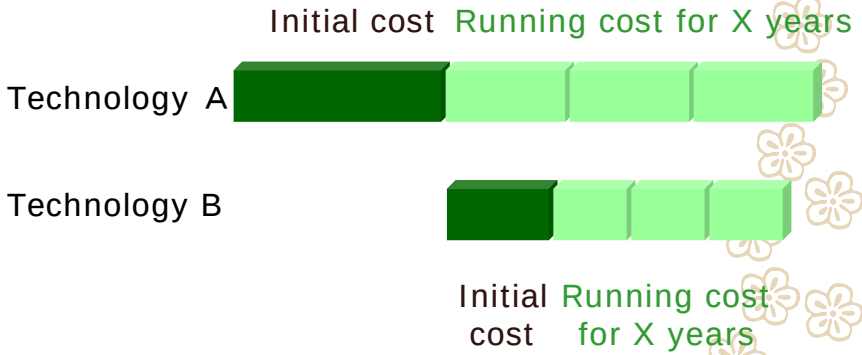




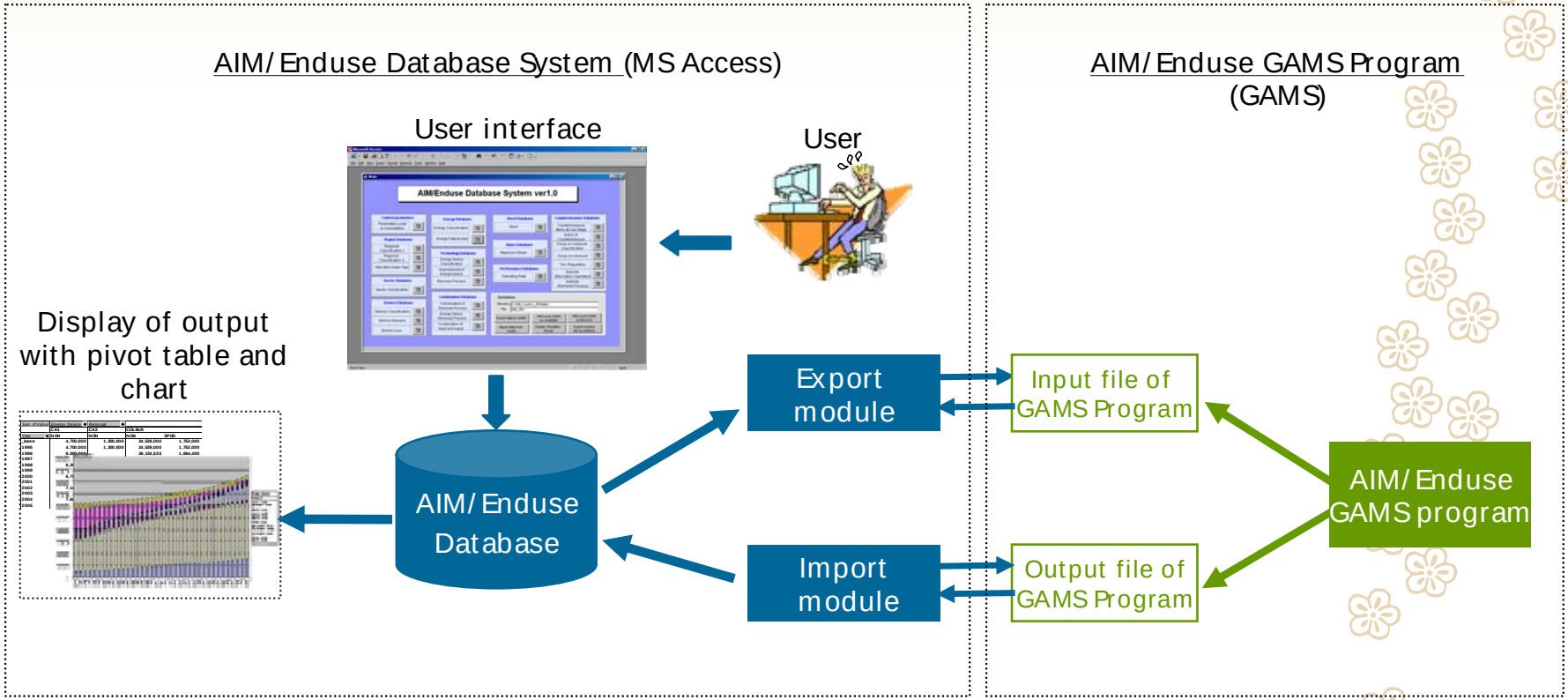
Examples of technology selection

3) Replacement of existing technology





AIM/Enduse Software

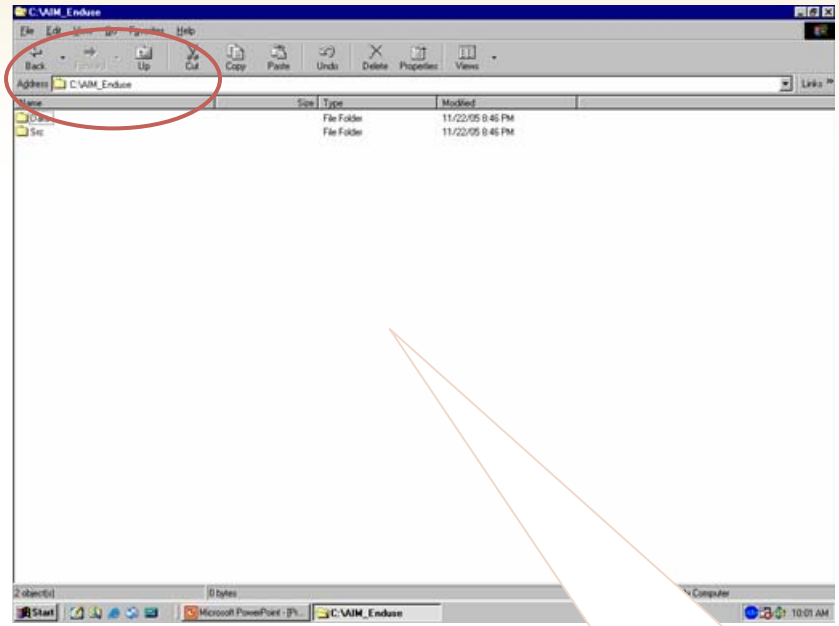


Definition of terms

- “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.

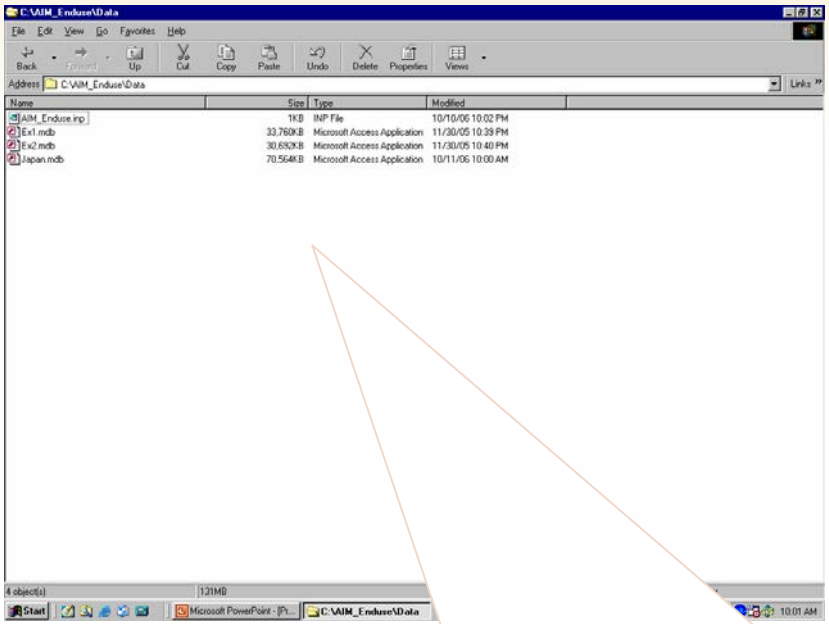
[2] How to operate AIM/Enduse Model

Installation (1)



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

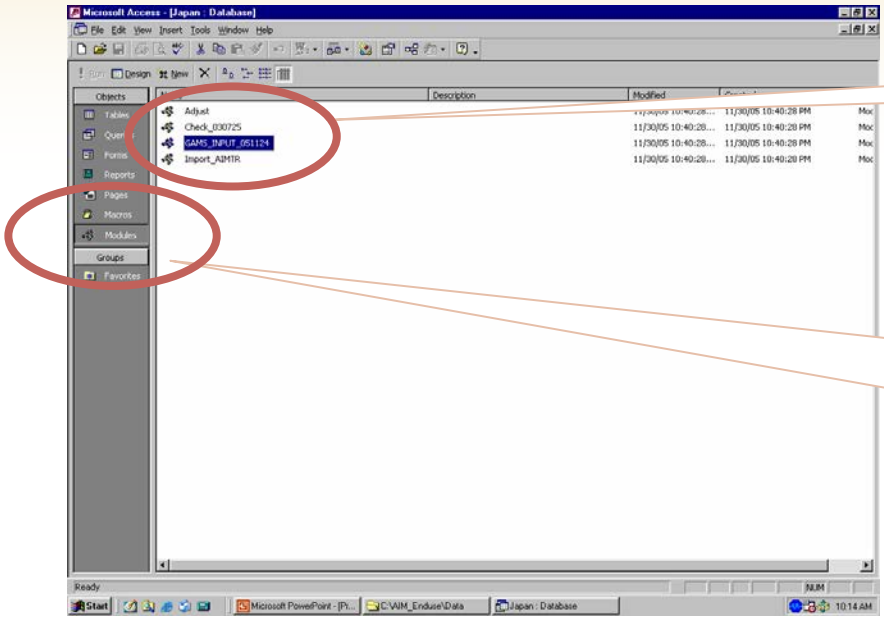
Installation (2)



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)

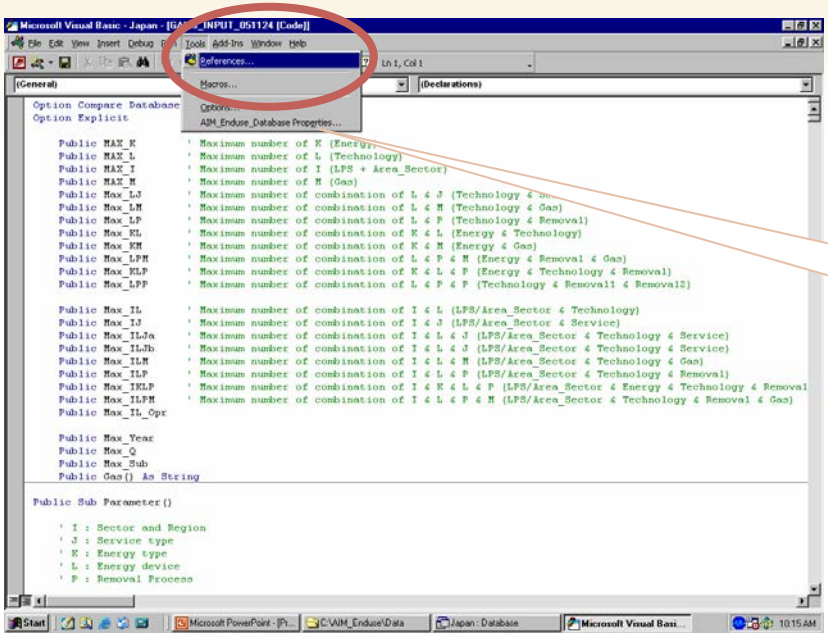


Click “GAMS_INPUT”

Click “.mdb” file and select “Modules” in “Ojects”

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

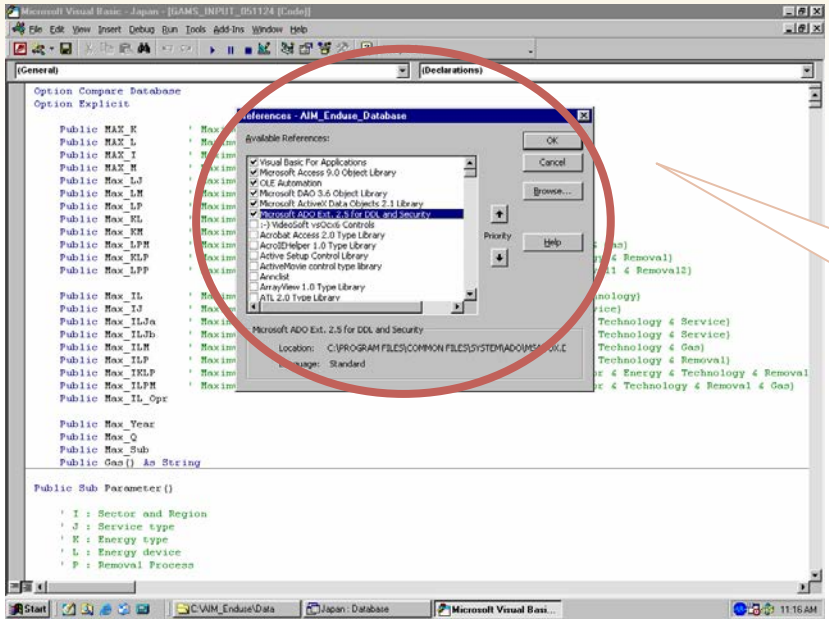
Installation (4)



Select “Tools”- “Reference”

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

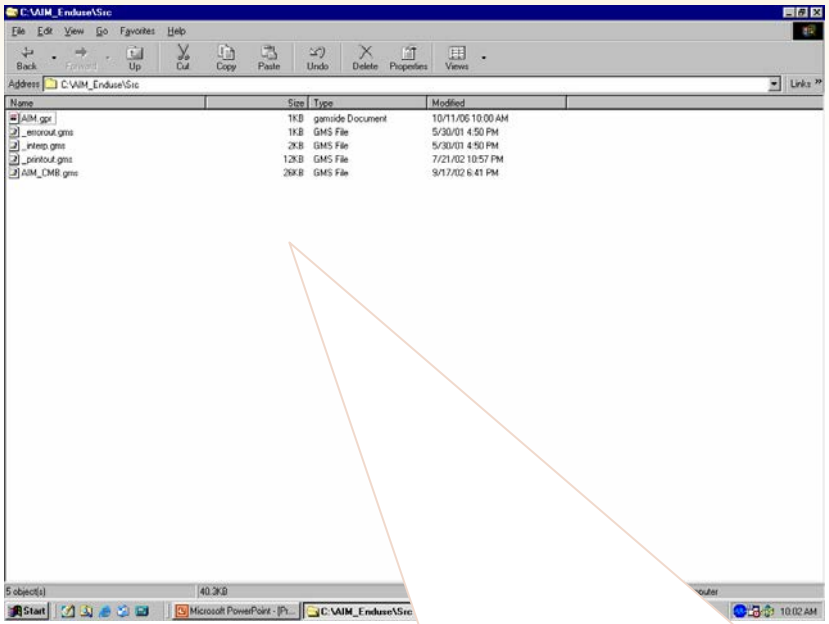
Installation (5)



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.

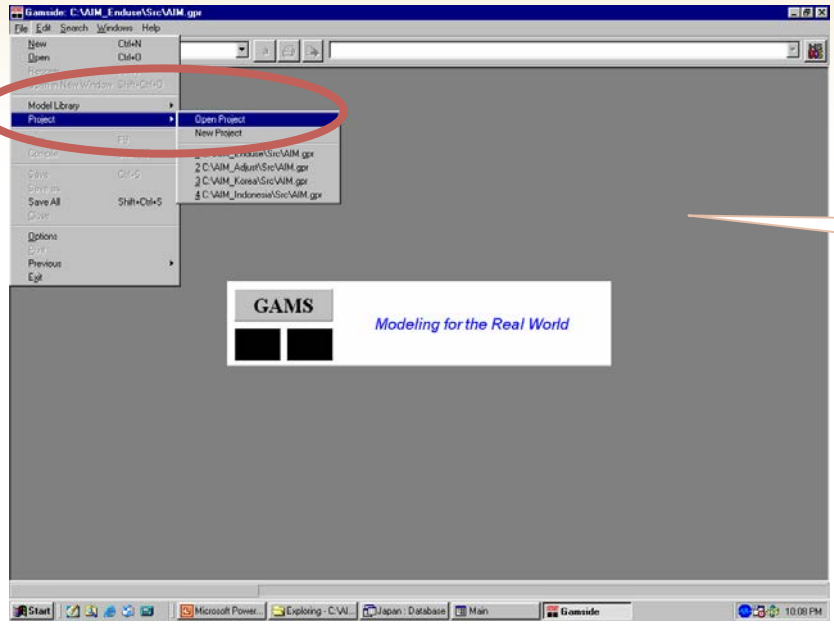
Installation (6)



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)

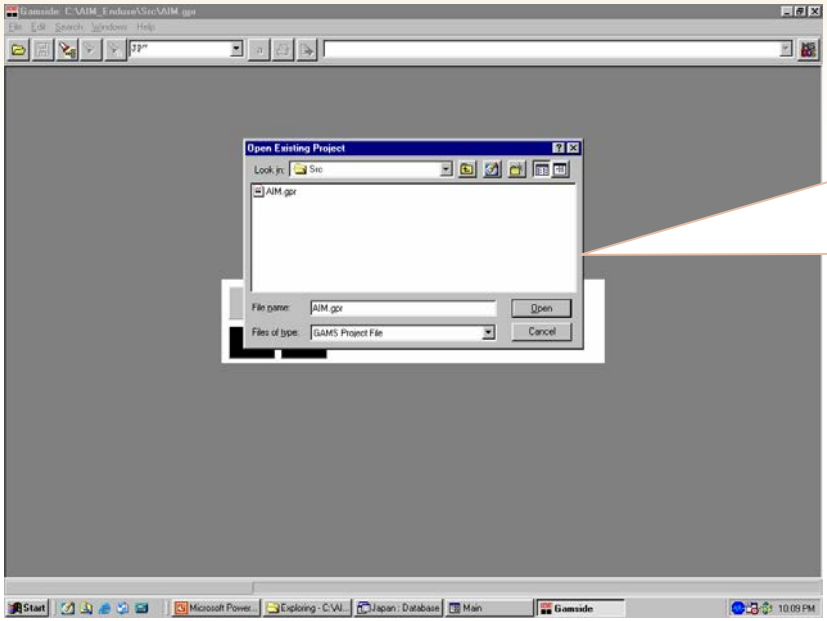
Installation (7)



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)

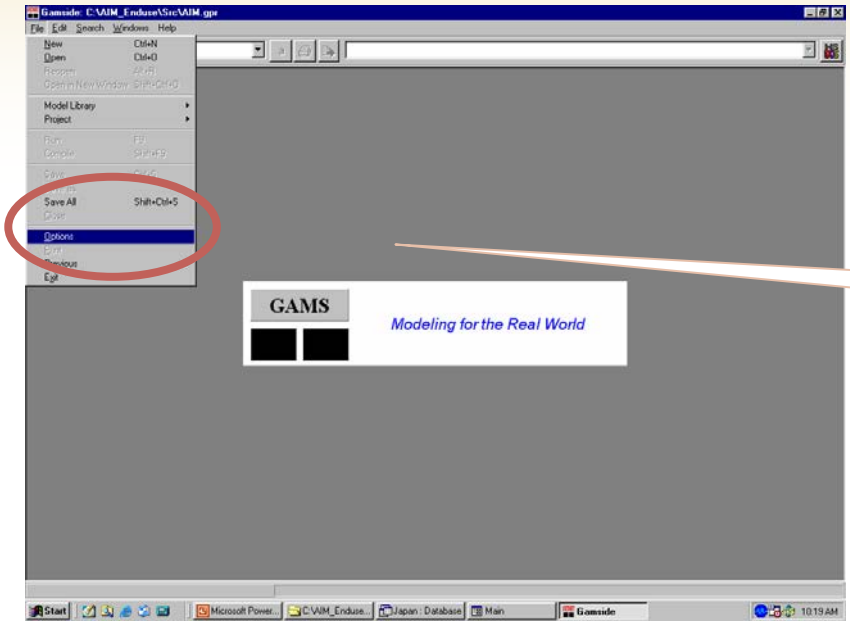


Open “AIM.gpr” in C¥AIM_Enduse¥Src

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.

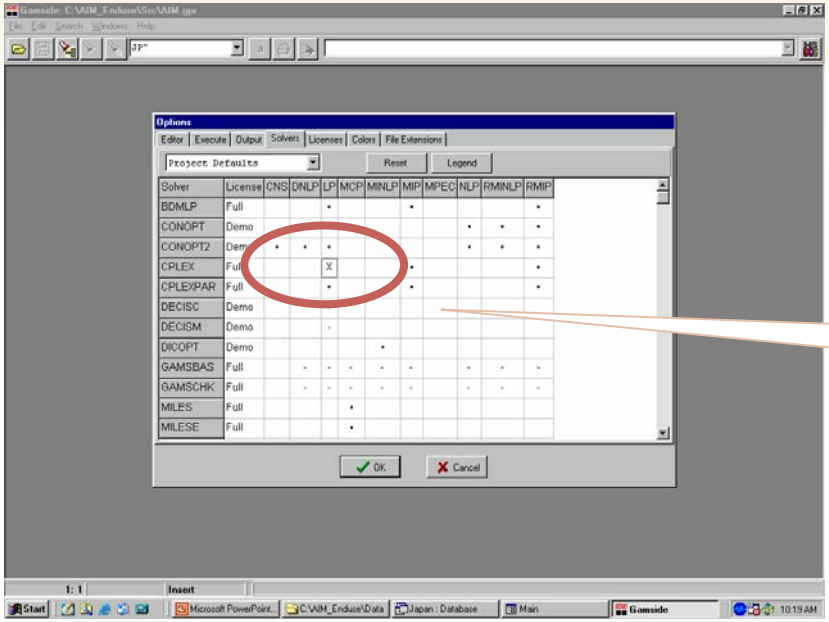
Installation (9)



Select “File” – “Options”

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

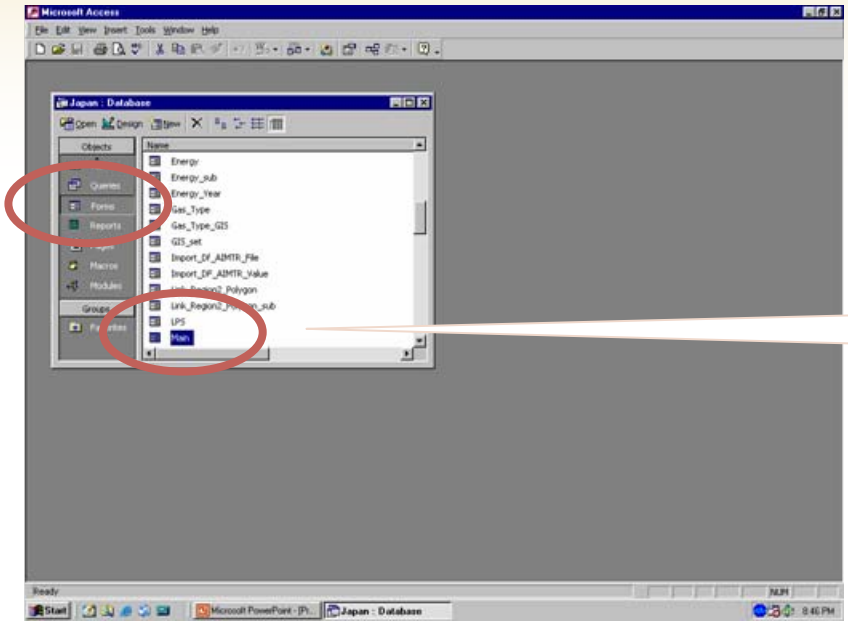
Installation



Select “CPLEX” as a solver

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

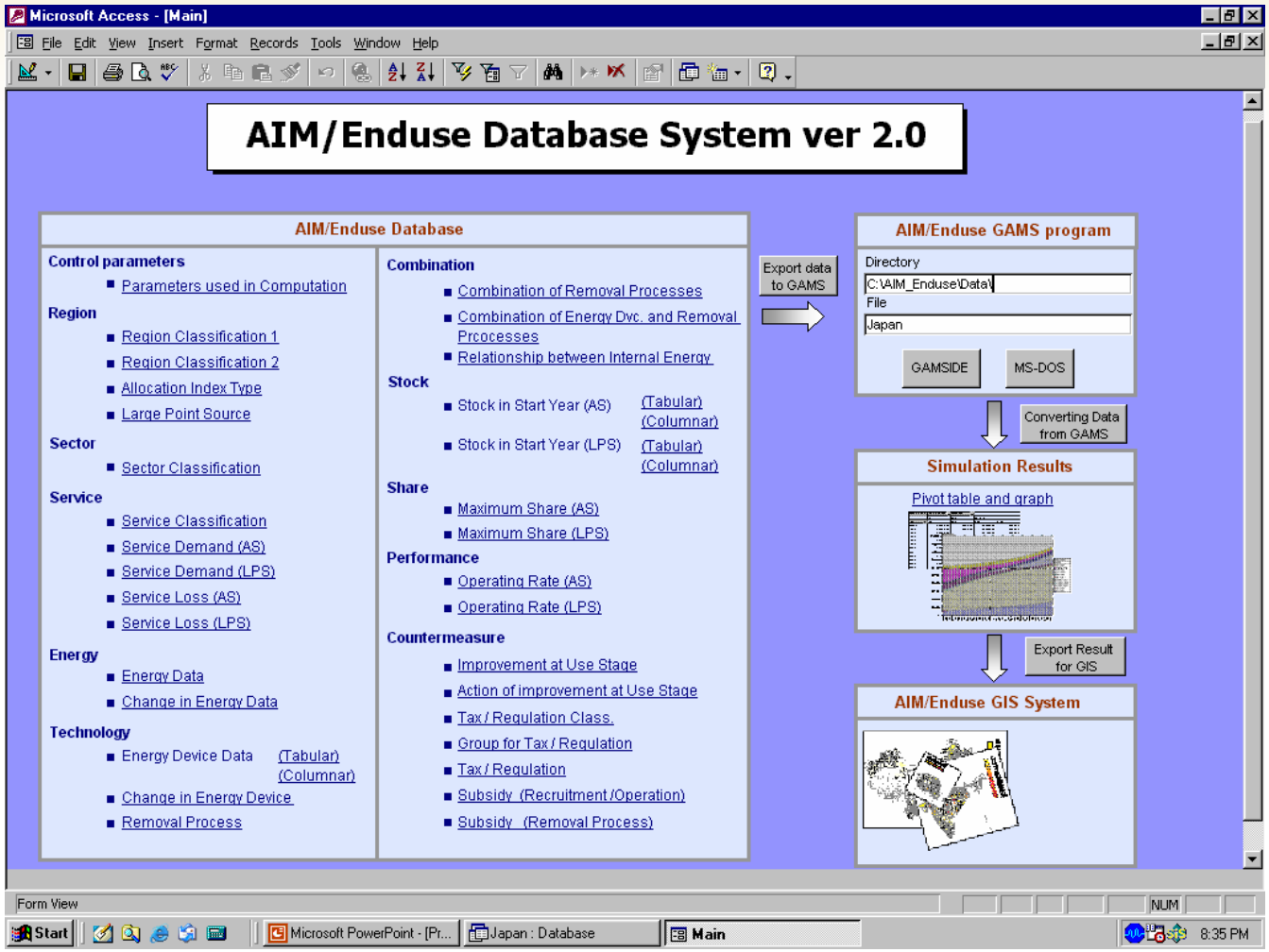
AIM/Enduse Database System



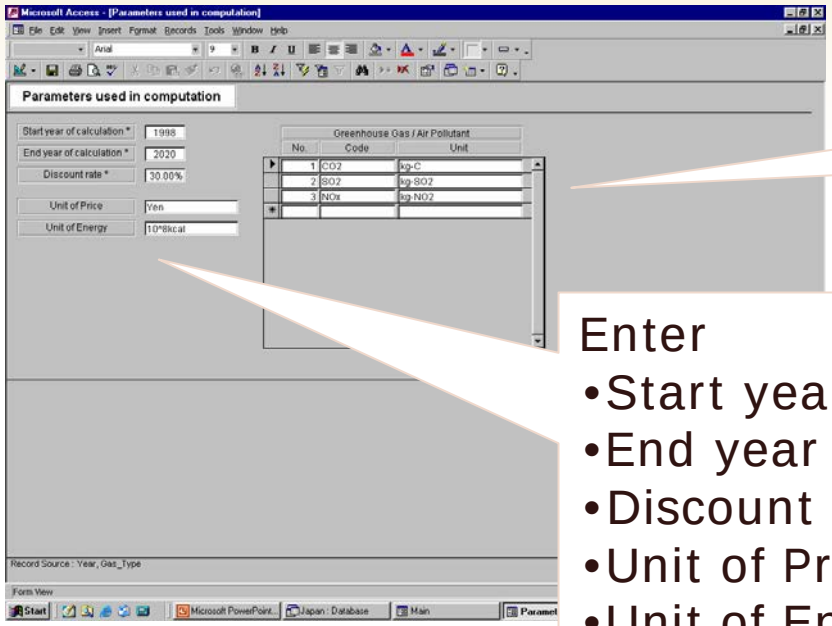
Select “Forms” and click “Main”

AIM/Enduse Database System is in Microsoft Access

AIM/Enduse Database System [Main]



Parameters used in computation

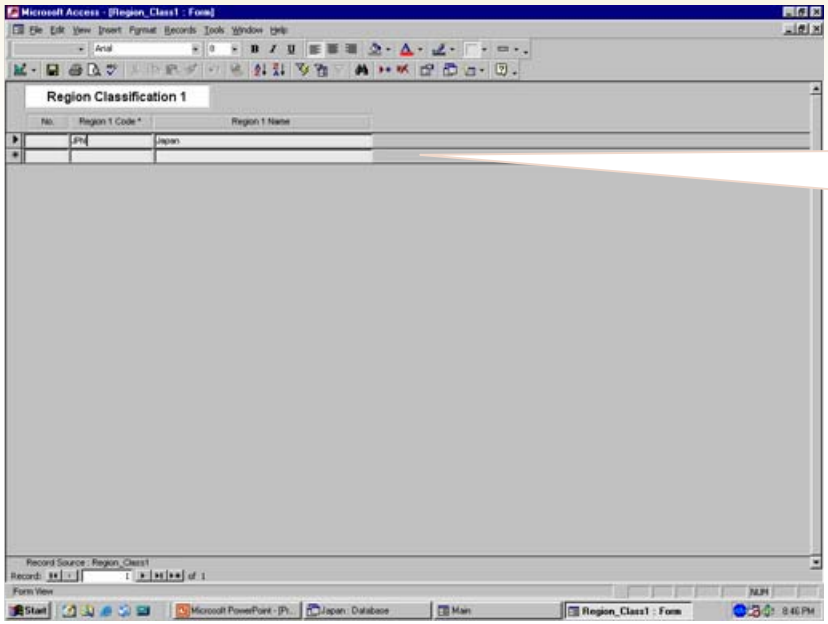


Enter
- Codes of gases
- Unit of gases

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 rte

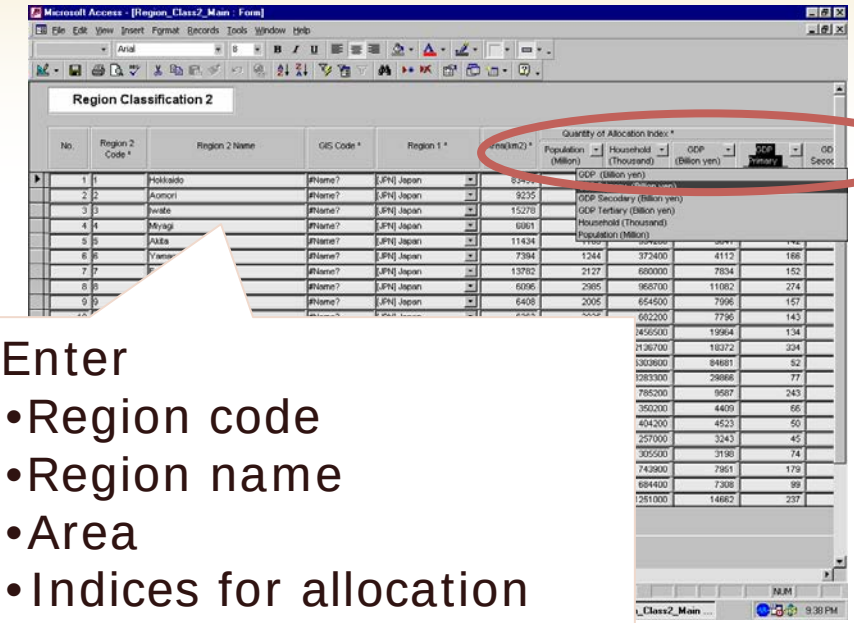
Region Classification 1



Enter
- Region code
- Region name

This form specify the aggregated region classification.

Region Classification 2

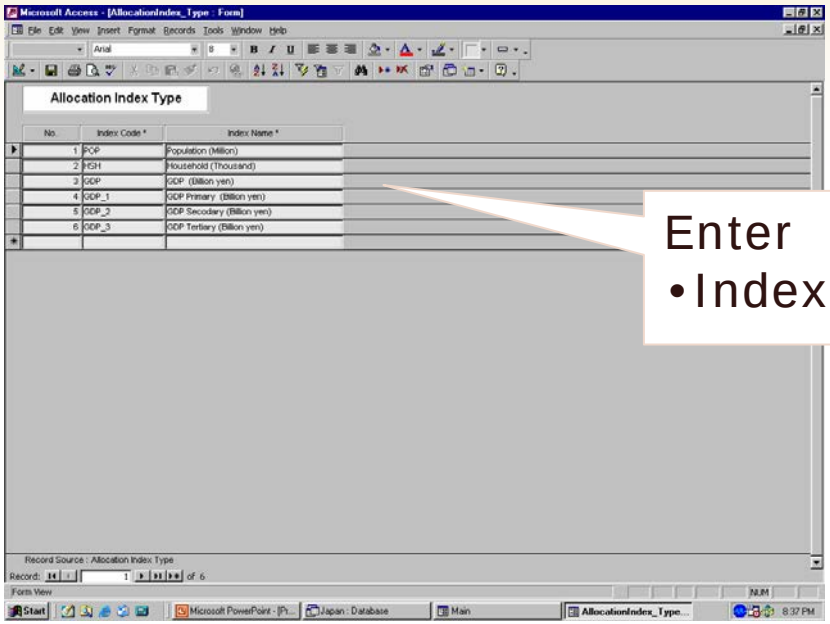


Enter
- Region code
- Region name
- Area
- Indices for allocation

Indices for allocation corresponds to the next form

This form specify the detailed region classification.

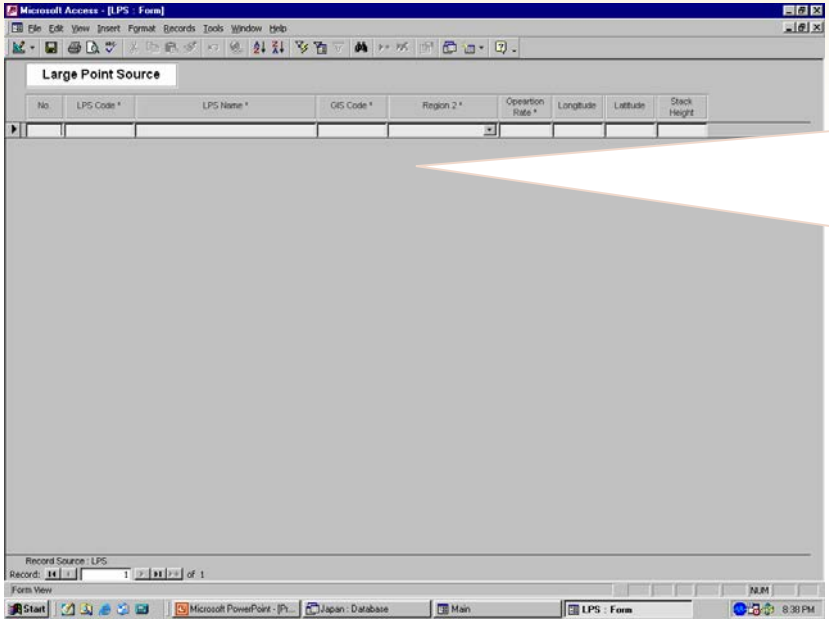
Allocation Index Type



Enter
- Index code and name for allocation

The emissions are calculated by region classificatio1 firstly, then allocated to region classification2 based on these indices.

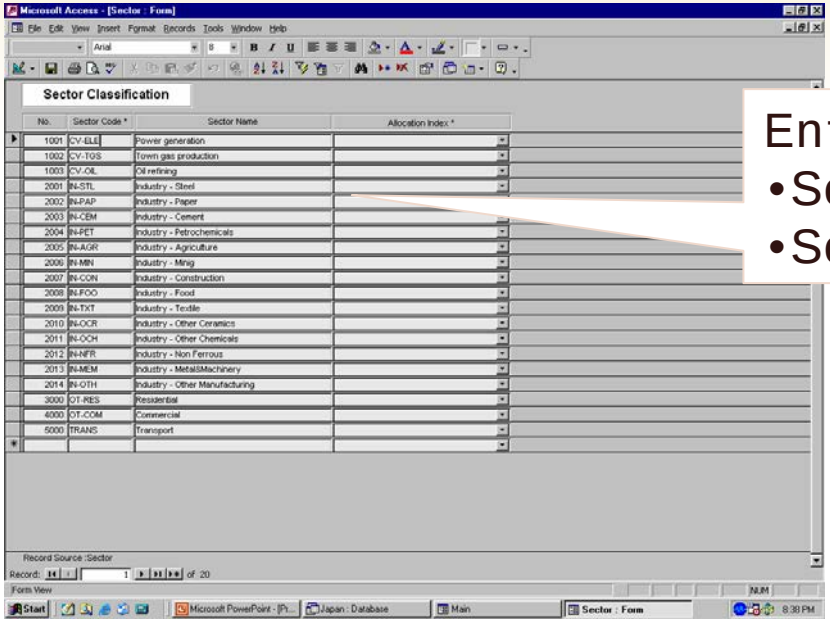
Large Point Source



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

This form specify large point sources.

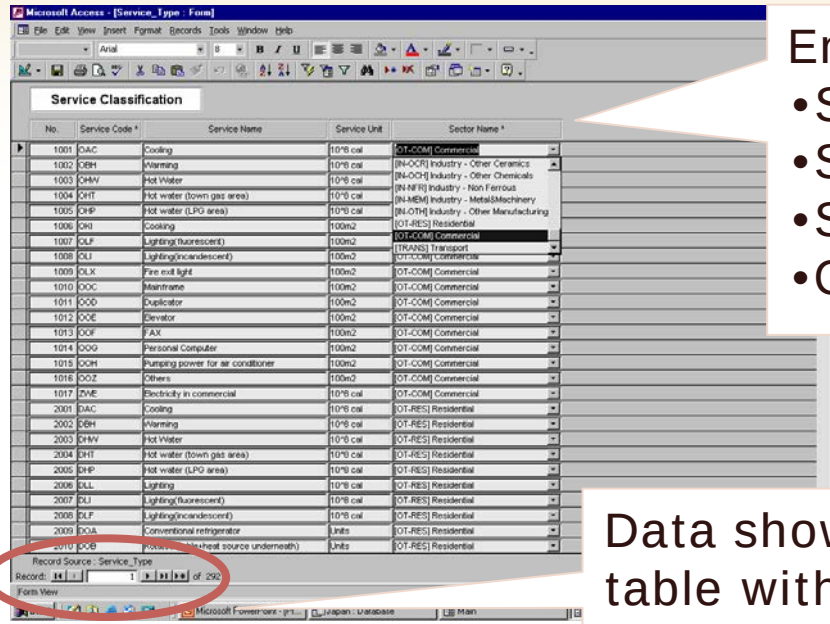
Sector Classification



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

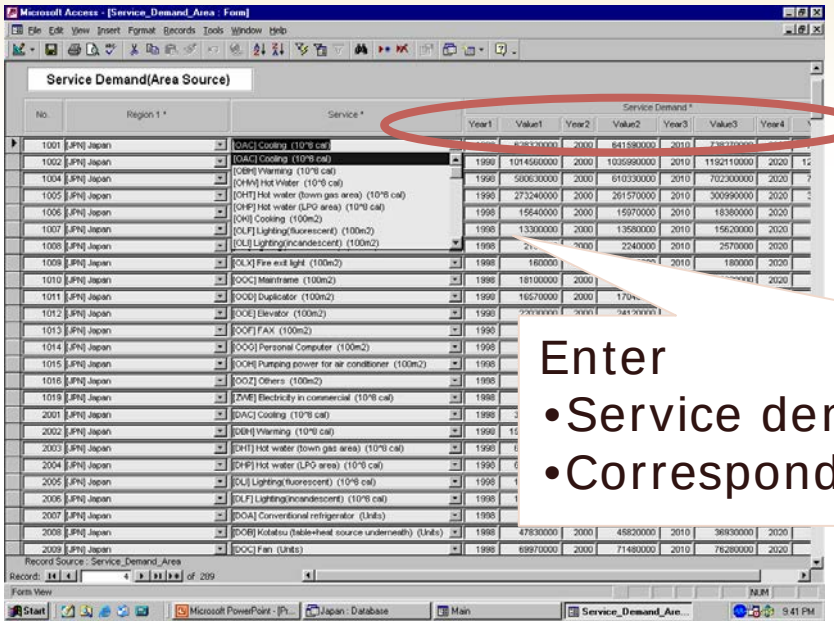


Enter
- Service code
- Service name
- Service unit
- Corresponding sector

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

This form specifies the service classification.

Service Demand (Area Source)

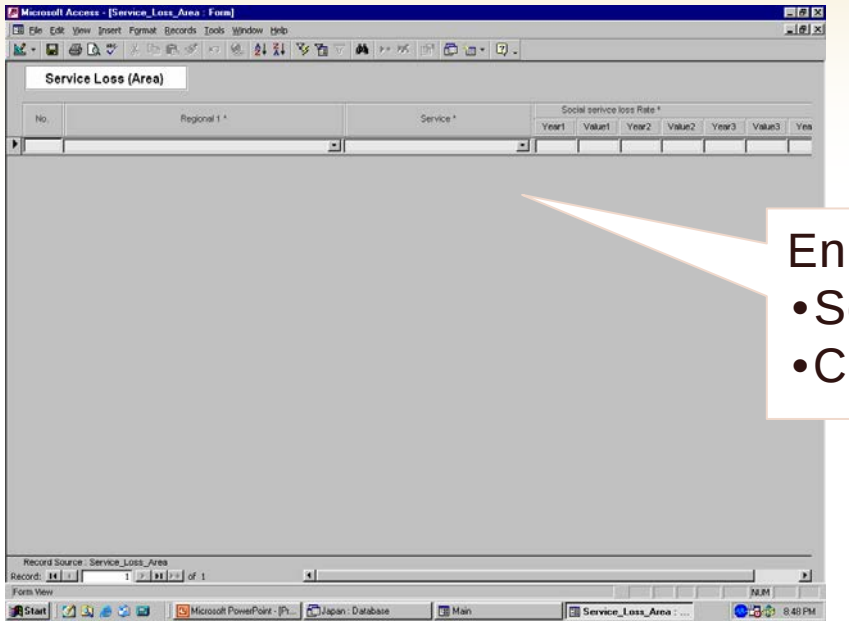


Linearly supplemented between years

Enter
- Service demand in area source
- Corresponding year

This form specifies the service classification.

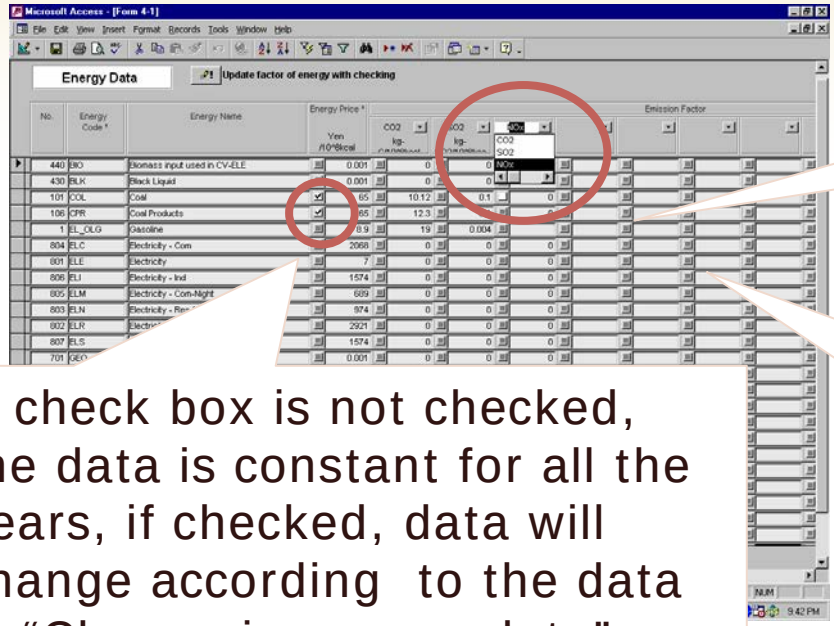
Service Loss (Area)



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



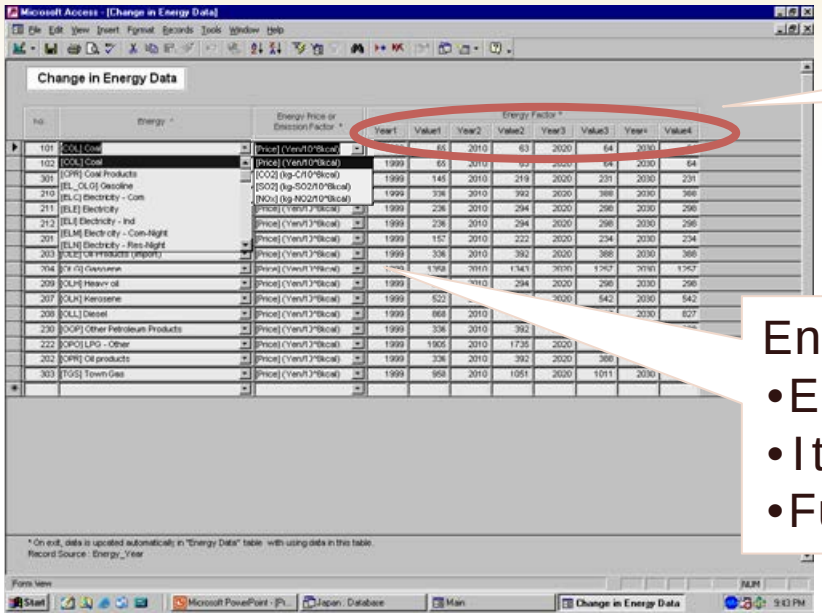
Gases correspond to "Parameter used in computation"

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

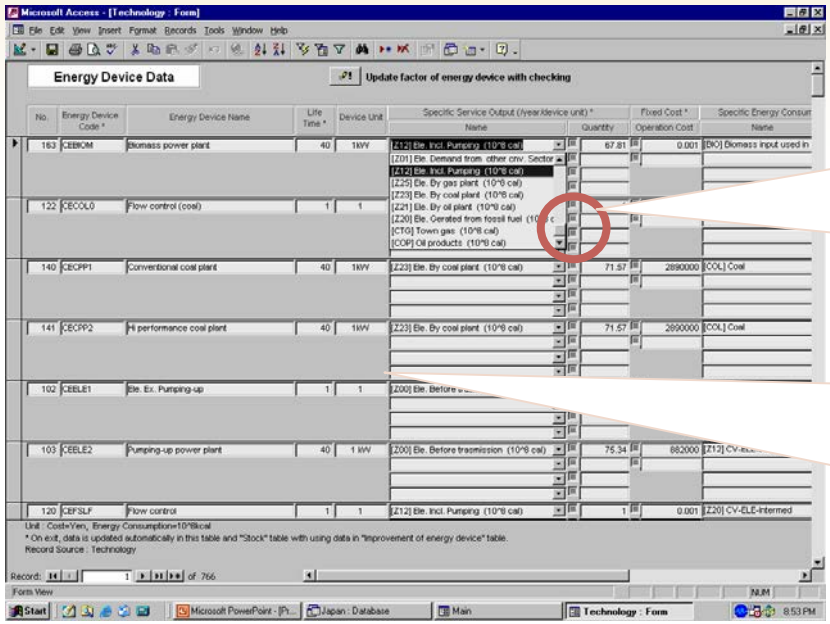


Linearly supplemented between years

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

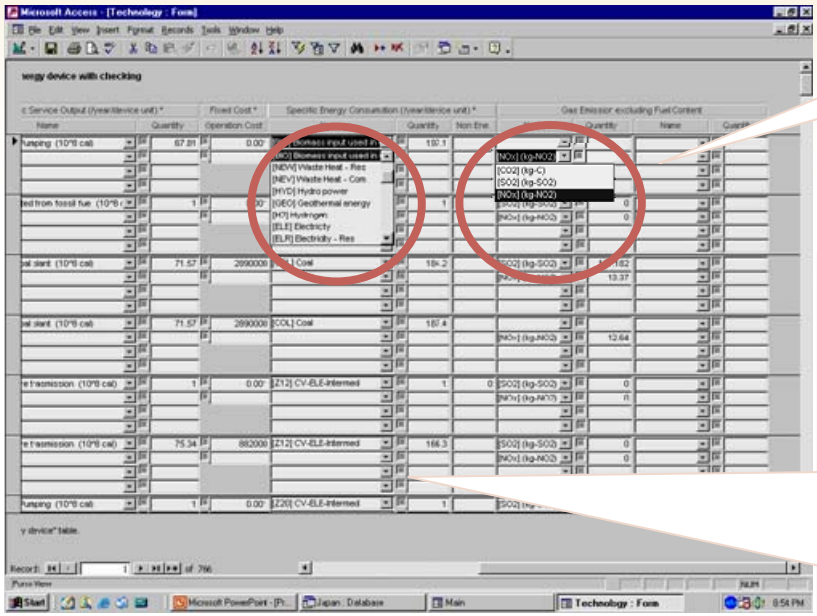


If check box is not checked, the data is constant for all the years, if checked, data will change according to the data in “Change in energy device data”

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.)

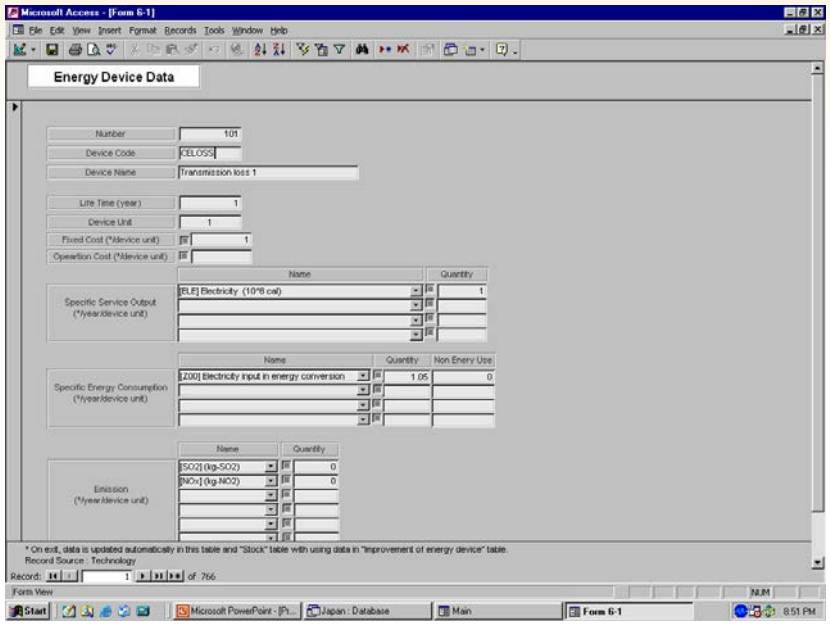


Multiple service output and energy input can be set

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

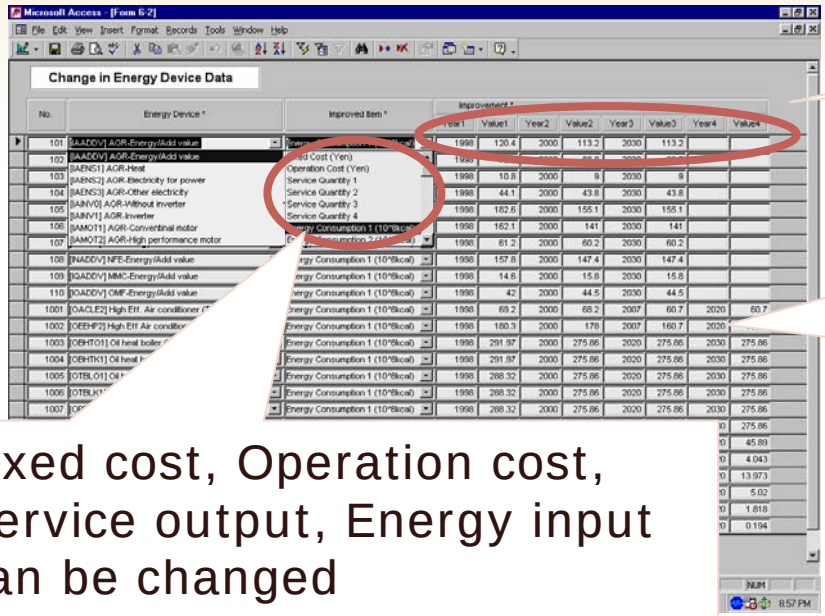
"Technology" includes two types of devices, "Energy device" and "Removal process". "Energy device" refers to the technologies which consumes energy and supply services.

Energy Device Data (Columnar)



"Energy Device Data" is shown in columnar in this form.

Change in Energy Device Data

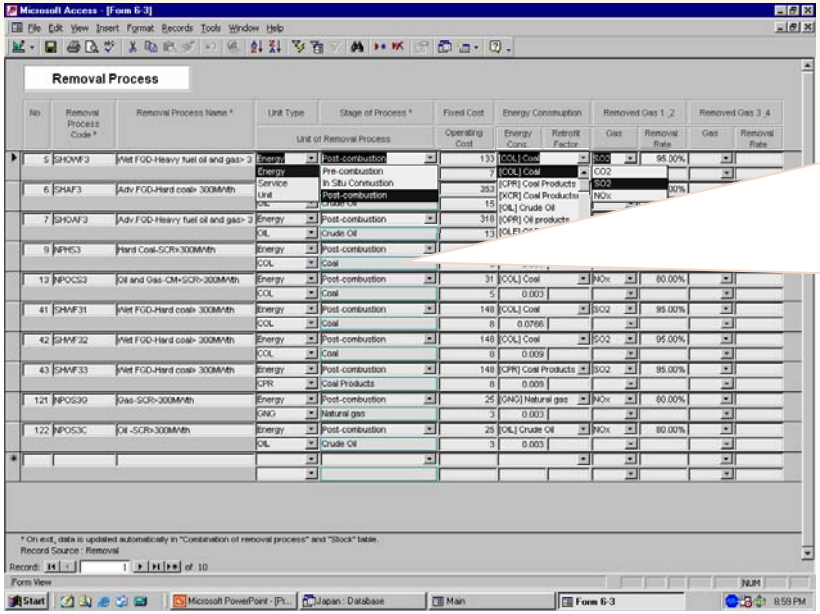


Linearly supplemented between years

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.

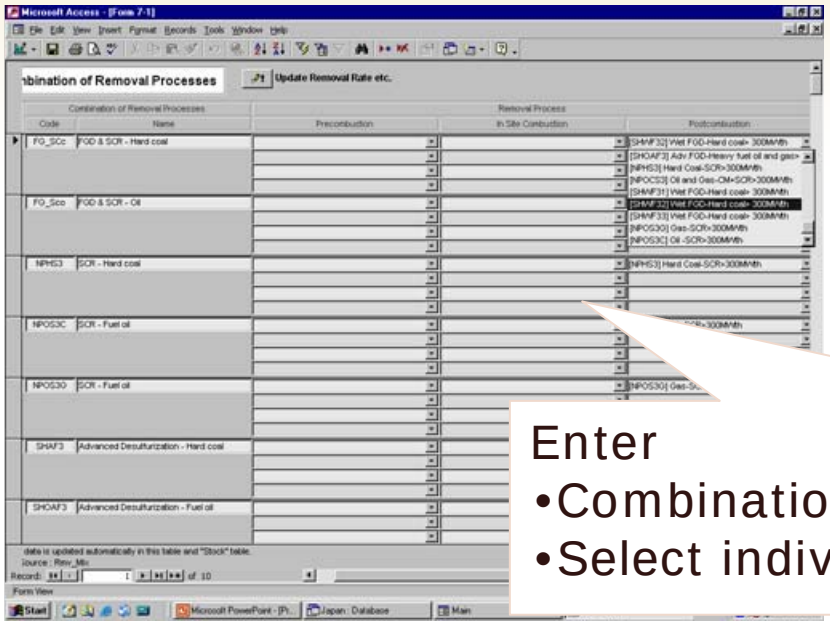
Removal Process



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.

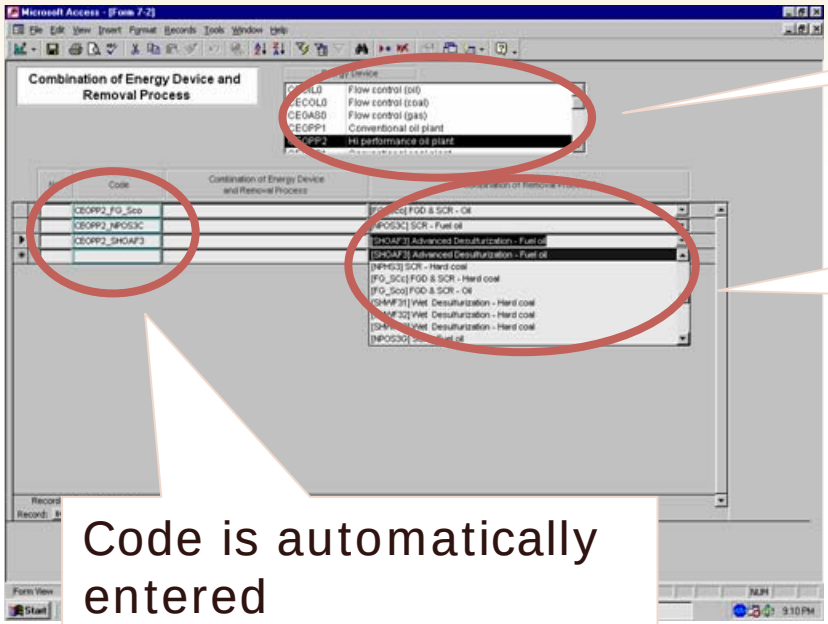
Combination of Removal Process



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



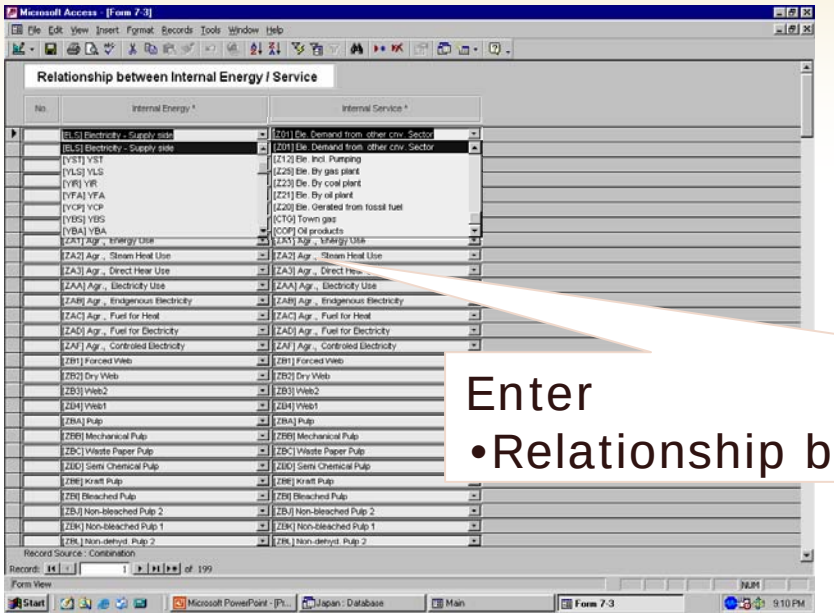
Energy devices are listed

Combination of removal process are listed

Code is automatically entered

Combination of energy device and removal process is defined here.

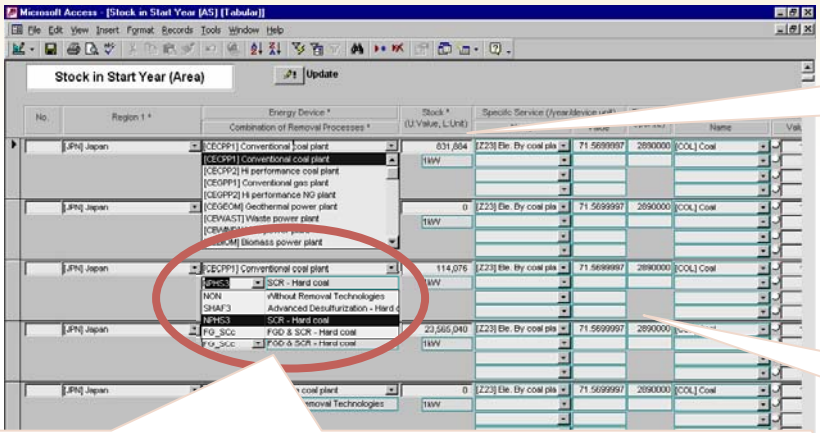
Relationship between Internal Energy/Services



Enter
- Relationship between internal energy/services

Relationship between internal/energy and service is defined here.

Stock in Start Year (Area)



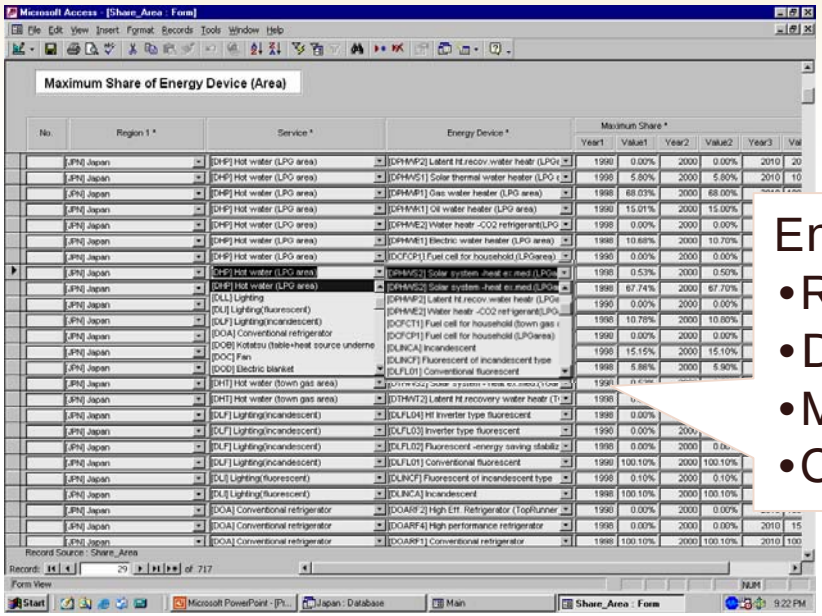
Enter
- Stock number of each technology

These green parts are entered automatically from “Energy device data”

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

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

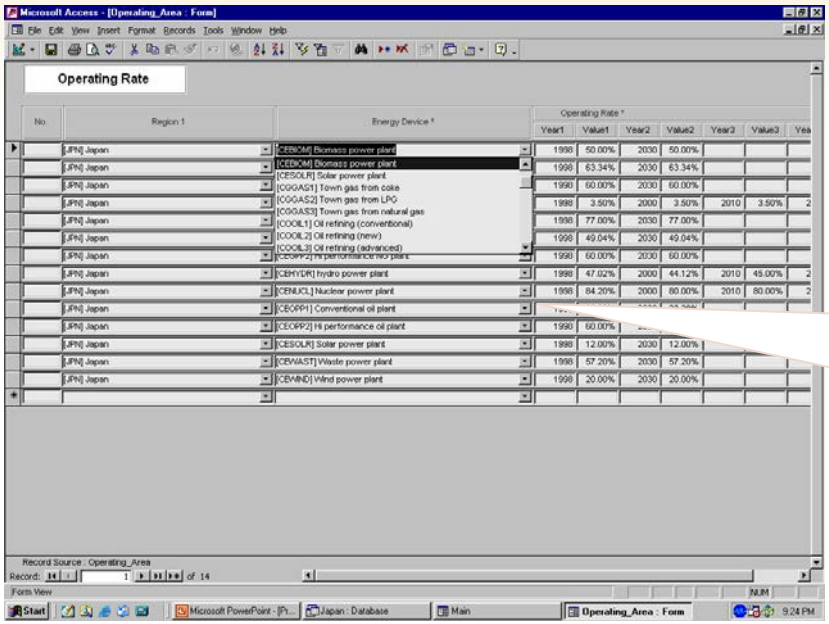
Maximum Share of Energy Device (Area)



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

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

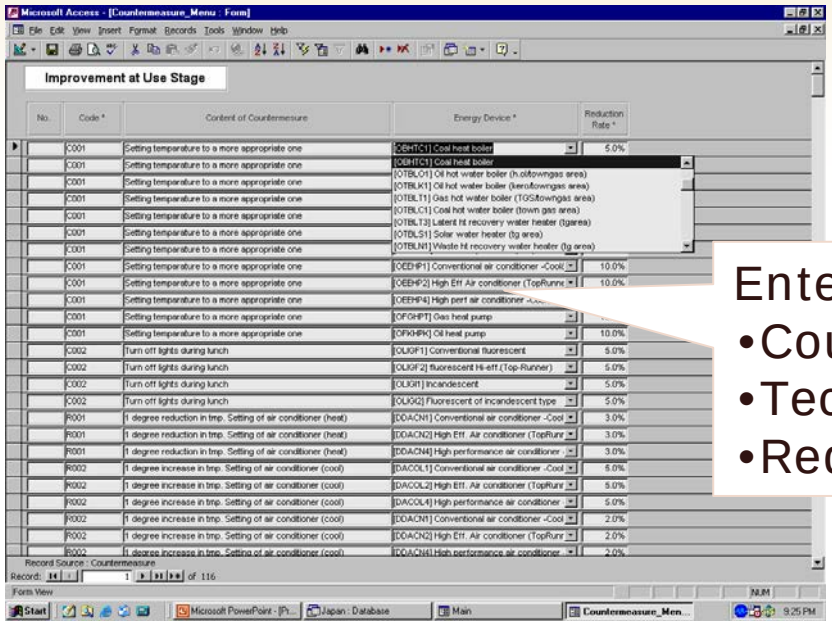
Operating Rate (Area)



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%.

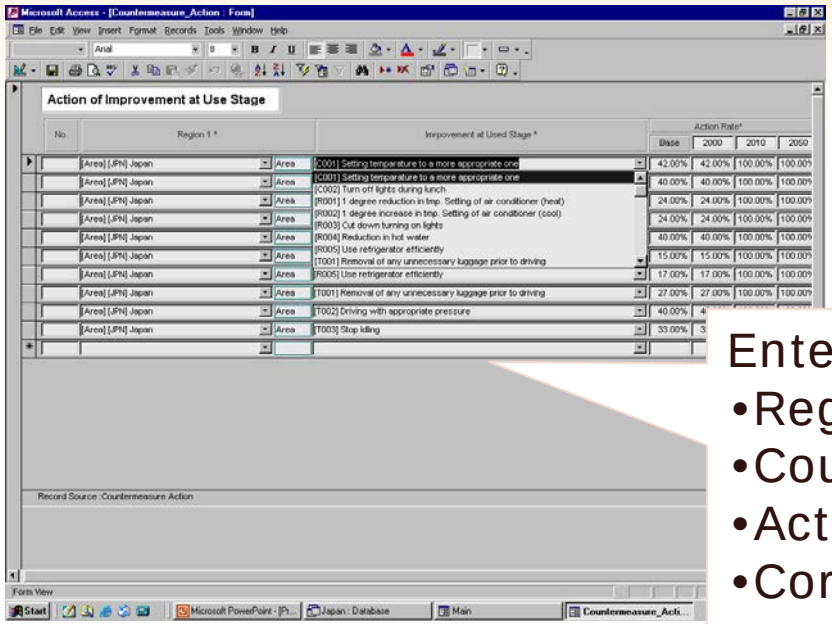
Improvement at Use Stage



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

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

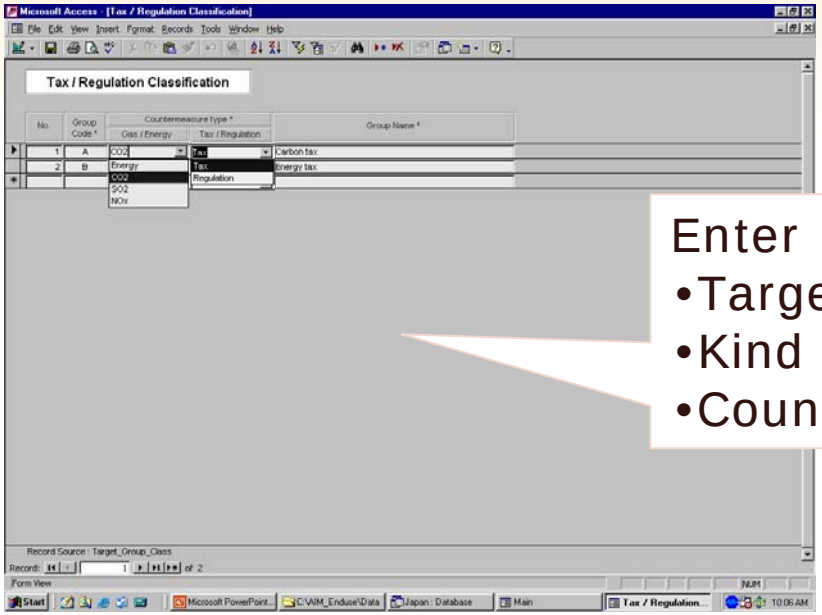
Action of Improvement at Use Stage



Enter
- Region
- Countermeasure
- Action rate
- Corresponding year

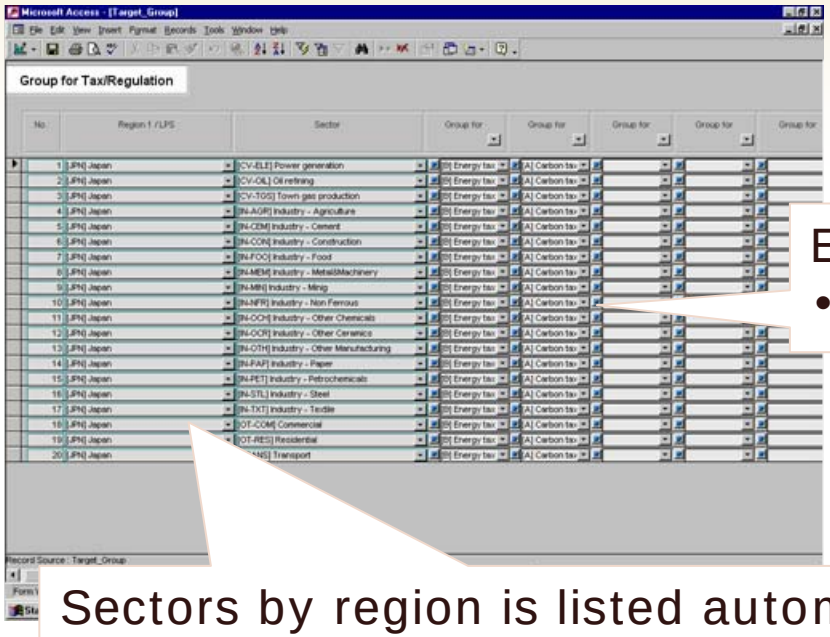
Action rate of “Improvement at use stage” is defined here.

Tax/Regulation Classification



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

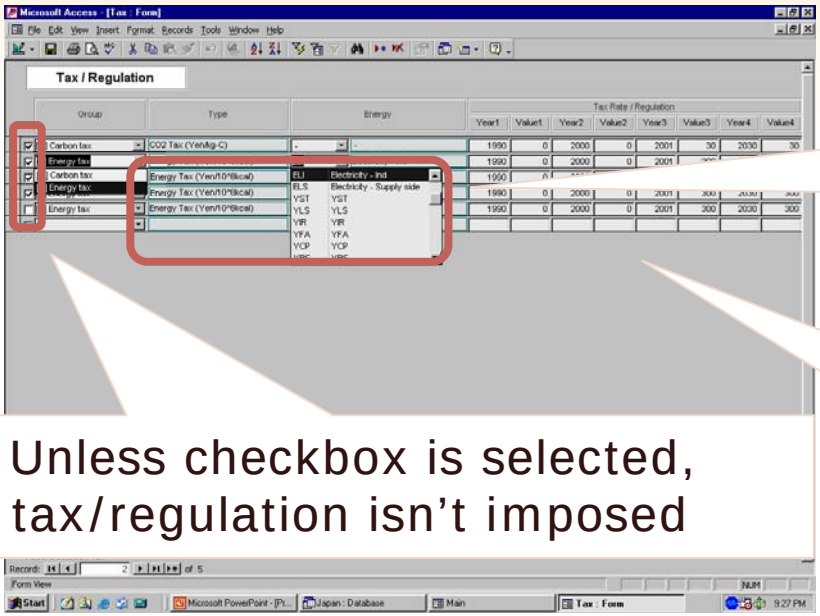
Group for Tax/Regulation



Enter
- Tax or regulation in the target sector

Sectors by region is listed automatically

Tax/Regulation

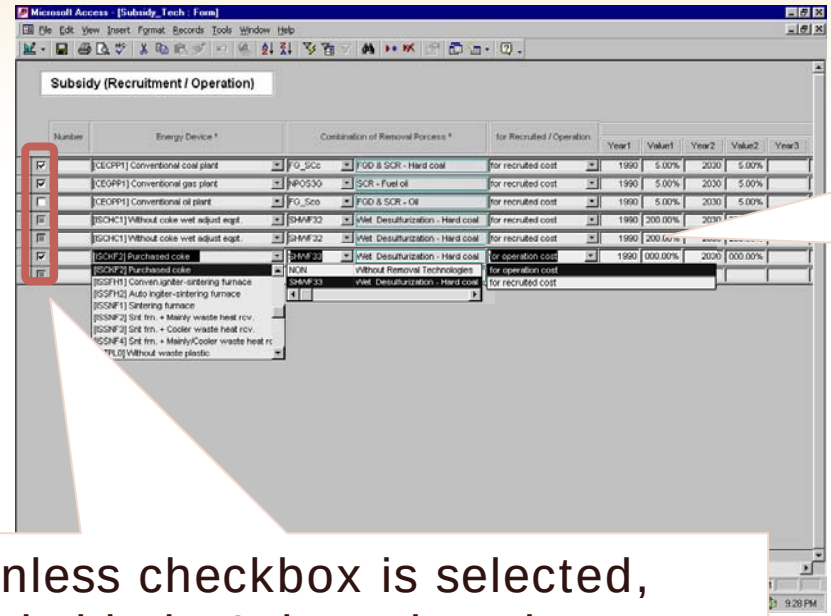


In case of energy tax/regulation, the target energy need be indicated

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

Enter
- Tax or regulation
- Tax rate
- Corresponding year

Subsidy (recruitment/Operation)

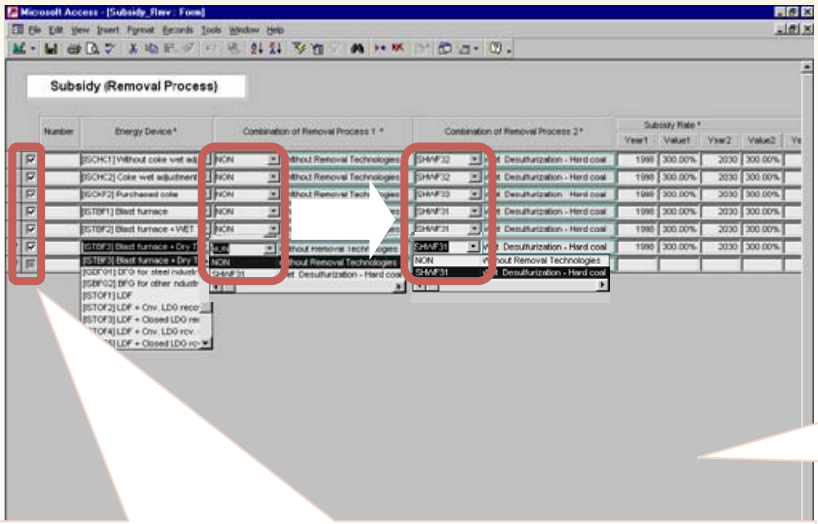


Enter
- Technology to be subsidized
- Recruitment or operation
- Subsidy rate
- Corresponding year

Unless checkbox is selected, subsidy isn't introduced

Subsidy for devices is defined here

Subsidy (Removal Process)



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

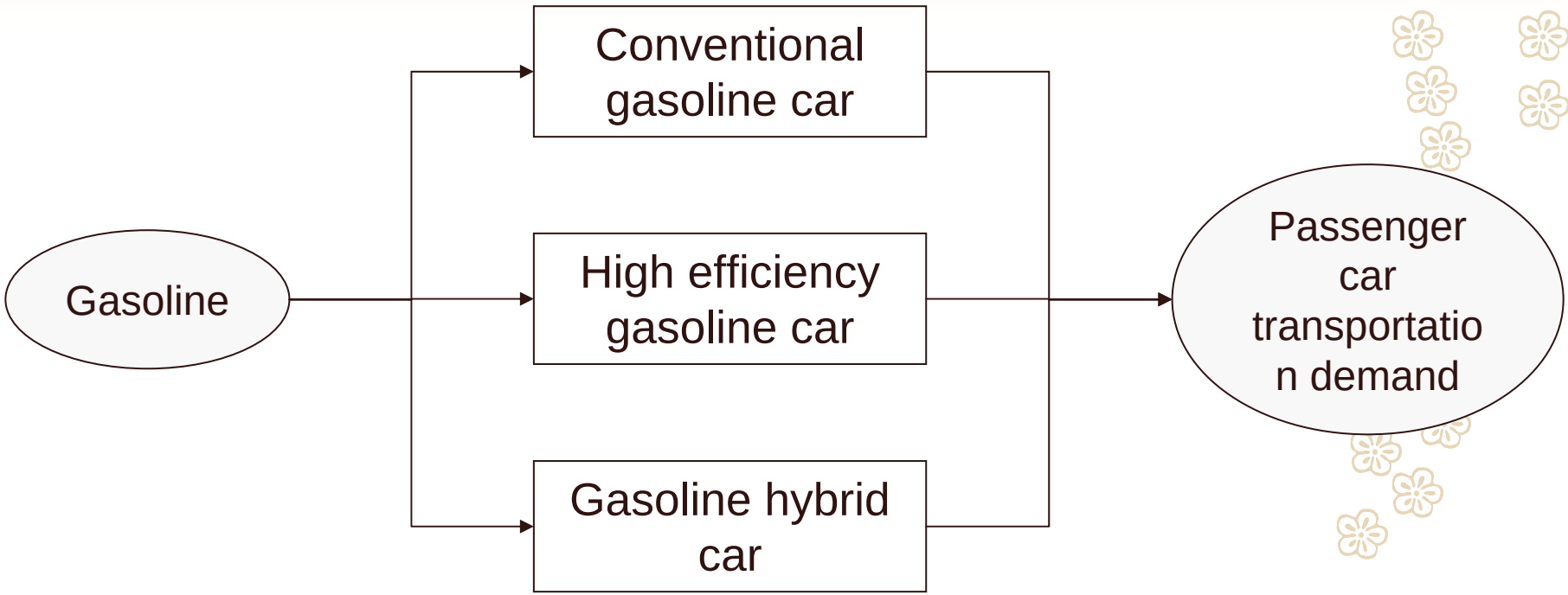
Estimate future emission from passenger car

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


Conventional gasoline car
Gasoline
High efficiency gasoline car
Passenger car transportatio n demand
Gasoline hybrid car

Assumption

A) Transportation demand of passenger car

		2000	2010	2030
TPRC	Passenger Car demand (10^3km)	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

=0.4$/kg * 1000

/ (1.07toe/t *41.868 GJ/toe)

=400 $/t / (44.80 GJ/t)

=8.93 $/GJ

CO2 emission factor

=18.9 kg-C/GJ

SO2 emission factor

=0.0038 kg-SO2/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 km/Unit) / (18 km/kg)
  *(1.07toe/t) /10^3 * 41.868 GJ/toe

=24.9GJ

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 km/Unit) / (24 km/kg)

*(1.07toe/t) /10^3 * 41.868 GJ/toe

=18.7GJ

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 km/Unit) / (36 km/kg)
  *(1.07toe/t) /10^3 * 41.868 GJ/toe
=12.4GJ

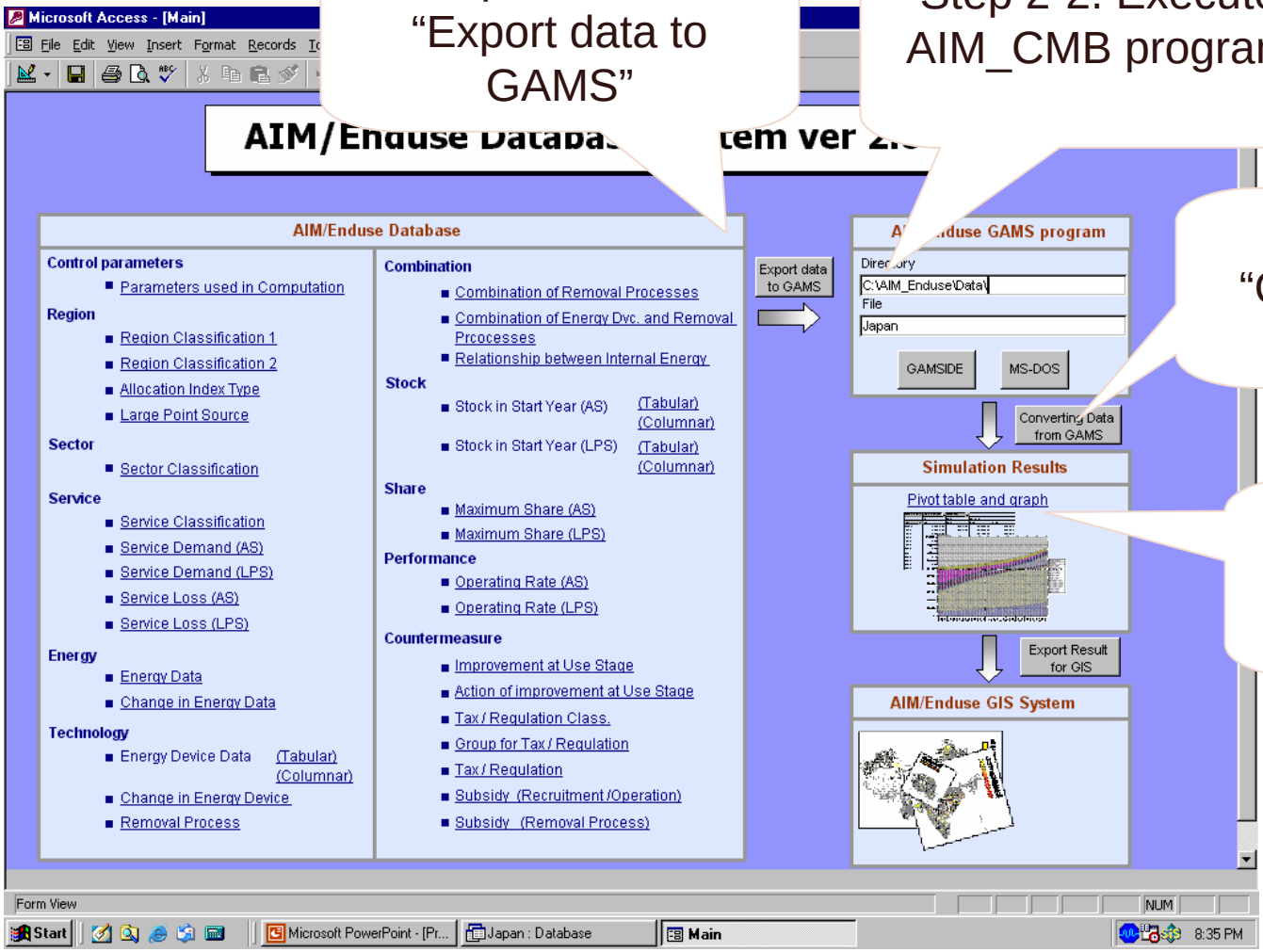
Step2: Simulation of reference case

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”



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)”

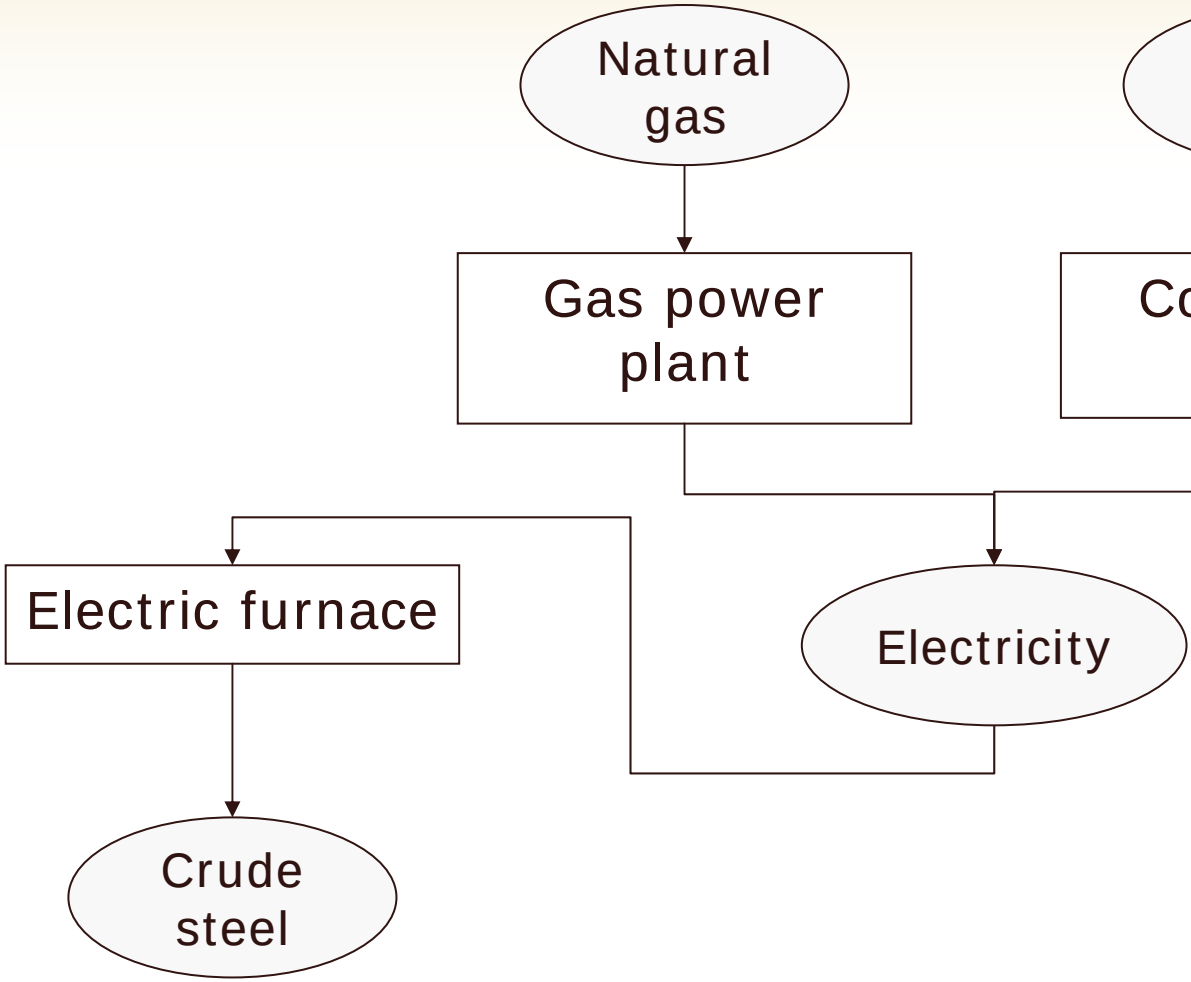
Step 5-2. Calculate future emission

	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


Natural gas
Coal
Gas power plant
Coal power plant
Electric furnace
Electricity
Crude steel

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$/kg
EN_GNG	Natural gas	0.2$/Nm3

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 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 “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$/kg * 1000 / (0.6 toe/t *41.868 GJ/toe)

=50 $/t /(25.12 GJ/t)

=2.0 $/GJ

CO2 emission factor

=25.8kg-C/GJ

SO2 emission factor

=0.333 kg-SO2/GJ

Step1: Data entry

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

Natural gas

Energy Price

=0.2 $/Nm3 * 1,000
/ (0.901 toe/ 1,000Nm3 *41.868 GJ/toe)
=200 $/1,000Nm3 / (37.72 GJ /1,000Nm3)
=5.3 $/GJ

CO2 emission factor

=15.3kg-C/GJ

SO2 emission factor

=0.001 kg-SO2/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)

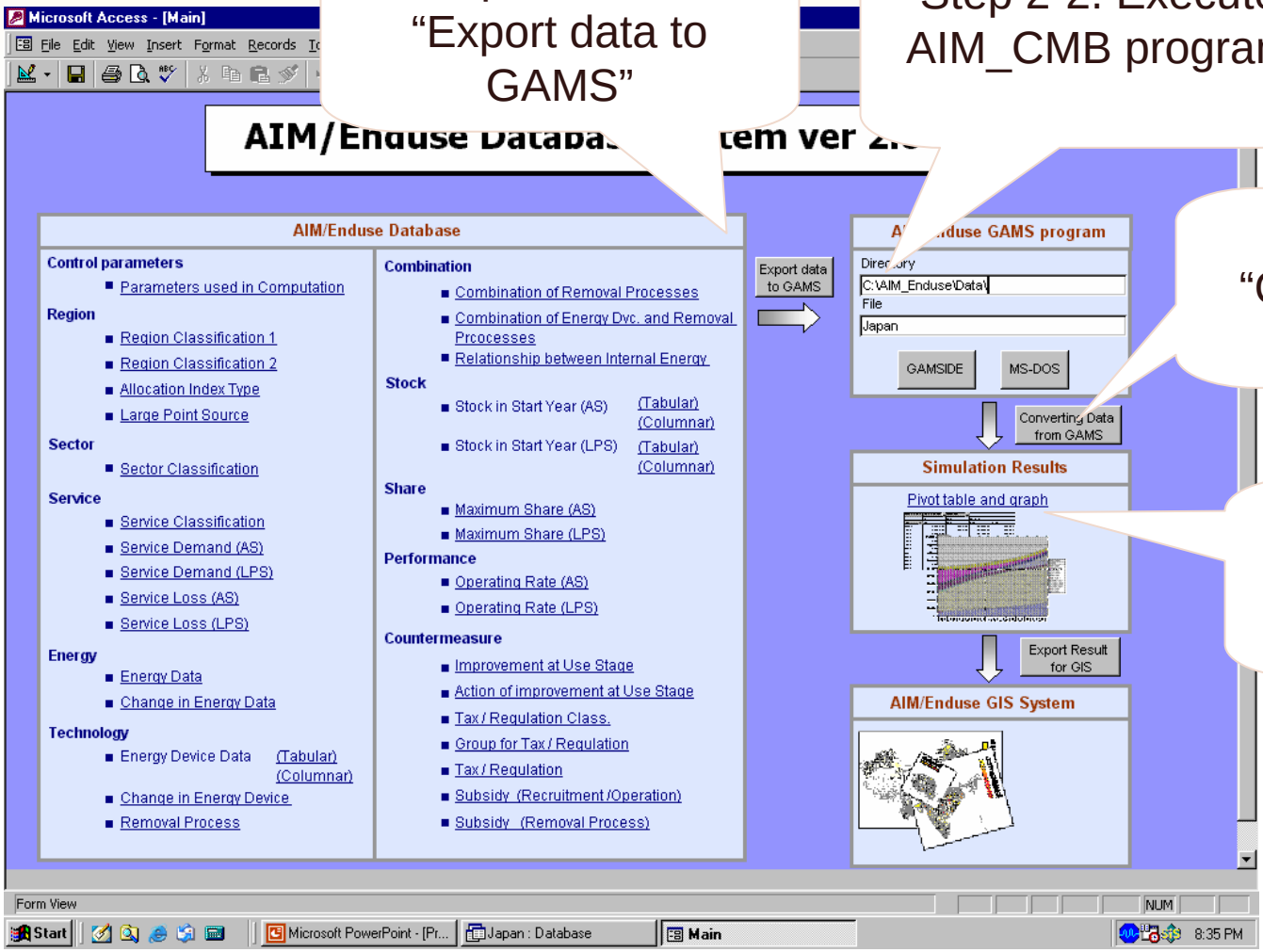
Step2: Simulation of reference case

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”



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