DOE/EIA-M072(2003)/2

Model Documentation Report: System for the Analysis of Global Energy Markets (SAGE)

Volume 2

Data Implementation Guide

August 2003

Office of Integrated Analysis and Forecasting
Energy Information Administration
U.S. Department of Energy
Washington, DC

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1. Introduction

As described in Volume 1, SAGE (System for the Analysis of Global Energy markets) is a bottom-up world energy model made up of individual regional or country level models. When all regions are included in a SAGE run, the results total world energy. Over and above the features available in existing models of this type, SAGE allows for time-stepped optimization and intra-period market adjustment algorithms. Complete documentation of the SAGE model is available in two volumes. Volume 1 provides a description of the SAGE approach for the general reader, the model user, and the programmer. Volume 1 also lists and provides vendor contacts for obtaining the necessary proprietary software.[1] This volume provides a guide to understanding the specific implementation behind each of the SAGE regional Reference Energy Systems. It describes the naming conventions, which are so important to the SAGE system and provides the reader with enough information to properly modify many important elements of the RES.

[1] The **source code**, written in the Generalized Algebraic Modeling System (GAMS) language is available from EIA.

2. General description

2.1 Regions

In SAGE, 15 regions are identified based upon political, geographical and environmental factors (Table 1). The table also indicates the code used in the model for these regions, and the number of countries included in each one. For more information, see Table A 1 in Appendix A of this volume, which contains the complete list of countries included in each region.

Furthermore, some sub-regions are defined in particular sectors. For example, the United States and Canada contain four and three sub-regions, respectively, in the residential and the commercial sectors. In the Reference Energy Systems of China, India and Mexico urban and rural sub-regions are used when considering residential and commercial energy services. Finally, there is a distinction between the OPEC (Organization of the Petroleum Exporting Countries) and Non-OPEC countries in the upstream sectors of Africa, Latin America, Middle East and Other Developing Asia.

Table 1. World Regions and Sub-Regions

Regions (15)	Codes	Countries[1]	Sub-regions
Africa	AFR	24+	OPEC, Non-OPEC (upstream sector)
Australia & New-Zealand	AUS	2	
Canada	CAN	1	West, Center, East (residential and commercial sectors)
China	CHI	1	Urban, Rural (residential and commercial sectors)
Latin America	CSA	23+	OPEC, Non-OPEC (upstream sector)
Eastern Europe	EEU	12	
Former Soviet Union	FSU	15	
India	IND	1	Urban, Rural (residential and commercial sectors)
Japan	JPN	1	
Middle East	MEA	15	OPEC, Non-OPEC (upstream sector)
Mexico	MEX	1	Urban, Rural (residential and commercial sectors)
Other Developing Asia	ODA	15+	OPEC, Non-OPEC (upstream sector)
South Korea	SKO	1	
United States	USA	1	Northeast, South, Midwest, West (residential and commercial sectors)
Western Europe	WEU	20	

2.2 Sectors

Each regional Reference Energy System (RES) includes five energy consumption (end-use) sectors, residential (RES), commercial (COM), agriculture (AGR), industrial (IND) and transportation (TRA), and two energy supply sectors, electricity production (ELC), and upstream/downstream (UPS) producing primary and secondary energy carriers other than electricity. Each RES contains data on the extraction, transformation, distribution and consumption of various energy carriers from 2000 up to a maximum time horizon of 2050. Note SAGE solves in 5-year increments thus there are a maximum of 11 periods.[2] Non-energy uses of energy/material products are also considered.

[1] See Appendix Table A1 for a complete list of the countries included in each region.

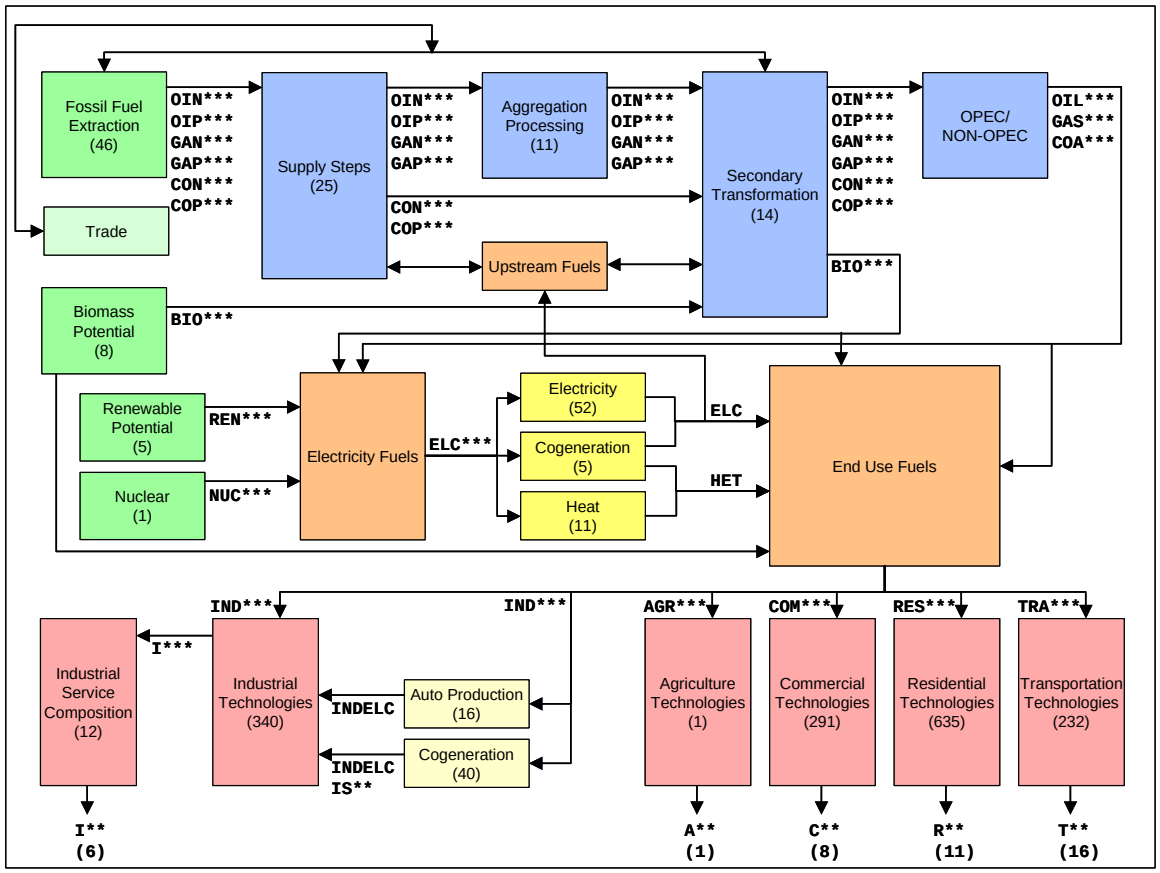
[2] SAGE, in support of EIA's *International Energy Outlook*, currently is used to produce energy market projections through 2025 and data covering years beyond 2025 have not been reviewed.

To model electricity producing and consuming technologies six time-slices (resulting from the combination of three seasons (winter, intermediate, summer) and two daily divisions (day, night)) are also modeled.

2.3 General structure

Figure 1 outlines the structure of a typical RES. *Energy commodities* are extracted or imported, processed by *technologies*, and eventually consumed by *end-use technologies* to satisfy a set of *demands for energy services*. Energy commodities are used either directly as feedstock (e.g. petrochemicals) or as energy fuels (for combustion, etc.). The number of technologies is indicated in brackets.

Figure 1 General Reference Energy System Structure



Energy production: One can see production of fuels in the following distinct blocks: primary production, secondary transformation, and production of electricity and heat. Primary production delivers the fossil fuels: crude oil, natural gas, and coal. This block is also the source of renewable energy and biomass. Secondary transformation technologies transform these energy carriers into fuels that can be used in the end-use sectors. The technology representation in these two blocks is generic. In implementing SAGE, however, each element of primary production is characterized by a 3-step supply curve, and the secondary transformation section mainly relies on a single flexible refinery technology. For example, for oil, three separate curves, representing, respectively, production from discovered reserves, undiscovered reserves, and unconventional

sources are defined, each having 3 steps. However, the production and consumption of electricity and heat are identified by specific technologies. Electricity production (and consumption) is tracked in three seasons and two parts of the day (6 time slices) annually. Utility supplied Heat is tracked by season.

Energy fuels: Energy fuels consumed in each sector are identified by the specific sector code defined in section 2.2 (RES, COM, AGR, IND, TRA, ELC and UPS). These sector fuels generally represent a mix of different energy commodities (e.g. RESDST is a mix of distillates, gasoline and non specified oil for the residential sector. Shares of each component fuel in the mix are based on historical consumption shares and may be modified by the user for the future)

Energy consumption: For each region, 42 energy service demands span the five end-use sectors (residential, commercial, agriculture, industrial and transportation). Most of these demand segments are specified in terms of the total energy needed. For the first period (2000), service demands correspond to the total energy consumed by existing technologies, and for future periods, projections are based on estimates of appropriate drivers (population, GDP, GDP per capita) and service demand sensitivities to these drivers.

Emissions: Combustion emission factors are calculated automatically for each technology, based on the fuel inputs of the technology and on the emission factors of the energy commodities included in the sector fuel. For non-energy consumption, specific emission factors are added at the technology level. Fugitive emissions, that are emissions not related to fuel consumption but to losses, venting, etc., are added at technology level.

User-defined constraints: User-defined constraints are usually introduced to reflect considerations beyond the scope of the model and to avoid abrupt, unrealistic changes over time. Such constraints may be defined to control the investment, capacity or operation of a set of processes in *absolute* (noted A_*) terms (e.g. capacity of nuclear plants) or as a *share* (noted S_*) of a larger set. For example, to simulate a renewable portfolio standard using SAGE the modeler can easily specify that at least 5 percent of electricity generation must be from the combined output of renewable generation technologies beginning in 2010, increasing each period by an additional 2 percent. In this case, the larger set (referred to as BigSet in Appendix A tables) consists of electricity output from all generation technologies (including renewable technologies) and the small set refers to generation from all renewable technologies in the RES. Similarly, such share user-defined constraints may be created to control the rate change in the fuel proportions at the end-use level and to manage the rate at which new or improved technologies penetrate the market. A typical way to proceed is to define market shares in 2005 using the base year information (2000) and to apply a ‘relaxation factor’, which decreases over time, in order to allow SAGE to be increasingly responsive to economic factors.

2.4 Data sources and units of measurement

Base Year Model Calibration

For the initial period fuel consumption per sector (including the different transportation modes and industries), primary energy production, and secondary energy production (electricity sector, refineries) levels are estimated based on energy balances for a common historical year.[1]

Estimates of consumption per sector are further disaggregated to reflect the:

- End-uses and sub-regions in the residential and the commercial sectors (e.g. split of residential fuels into heating, cooling, lighting, etc.),
- Energy services in each industry (process heat, machine drive, etc.), and
- End-uses in the transportation sector (autos, lights trucks, etc.).

To develop projections of future energy service demands, estimates of economic drivers (e.g. population, gross domestic product and GDP per capita) are used in conjunction with user assumptions on the topic of service demand sensitivity to these drivers. Other international data sources provide drivers for some end-uses in physical units (e.g. the number of households, the industrial production in millions tons or the vehicle-kilometers for autos). The modeler is free to add additional drivers and to make alternative assumptions regarding service demand sensitivity to the driver.

Data for existing power plants, energy resources, renewable potentials and energy trading were estimated by EIA. Technical and economic data characterizing new technologies are based upon existing literature and engineering judgment.[2]

Table 2. Data Sources

Data	Source
Existing (2000) fuel consumption per sector	IEA, 2001, calibrated to EIA totals
Split of energy consumption for sub-sectors	Analyst assumptions
GDP, Population (used for demand projections)	EIA, United Nations
Number of households, industrial production, vehicle-km driven (current situation)	United Nations, 1997, 2000 and 2001
Primary energy production and secondary energy production (electricity sector, refinery)	IEA, 2001 calibrated to EIA totals
Fossil and renewable resources	EIA
Existing power plants capacity	EIA
Refinery capacity	EIA, Oil and Gas Journal
Energy trading (amount and prices)	EIA
Existing technologies (cost data)	Expert judgment
New technologies (technical and cost data)	Available literature, SAIC report
Emission coefficients	NEMS and Environment Canada, 1992, 1997

Table 3 lists the units of measurement for the different kinds of data used in SAGE. The energy flows in the model are in Petajoules (PJ). However, the results are often displayed in other units (e.g. Quadrillion Btu, Millions of Barrels of Oil per Day, etc.)

1 For example, for initial SAGE calibration was supported by the International Energy Agency, 2001. *Energy Statistics and Balances of Non-OECD Countries*. Paris (France): IEA Publications, International Energy Agency, 2001. *Energy Statistics and Balances of OECD Countries*. Paris (France): IEA Publications.

2 SAIC, Development of Technology-Related Information for Use in the SAGE World Model, May, 2003.

The choice of units determines appropriate data values associated with technology characterizations. For example because energy flows are measured in PJ and all road transportation energy services are measured in billion vehicle kilometers per year (B-VKMS), investment costs are expressed in units of millions of 2000 US dollars per B-VKMS. Similarly, the efficiency of road vehicles is expressed in units B-VKMS/PJ (the efficiency of a gasoline car is in units B-VKMS/PJ of gasoline). As the reader will discern, the cost-related calculations require one additional assumption--vehicle kilometers per year for each of the vehicle classes identified in SAGE. When developing technology cost data for new road vehicles or any other technology careful attention to SAGE units of measurement is necessary.

Table 3. SAGE Units

Data	Unit
Energy flows	
All	PJ/year
Demands	
Transportation: Aviation, Rail, Navigation, Non-Energy Uses	PJ/year
Road Transportation Demands	Billion vehicle-kms/year
Residential	PJ/year
Commercial	PJ/year
Industry: Non-Ferrous, Iron and Steel, Pulp and Paper	Mt
Industry: Chemicals, Non-metallic minerals, Other Industries, Non-Energy Uses	PJ
Non-Specified	PJ
Capacities	
Power Plants and CHP (including upstream cogeneration, industrial auto-production and industrial cogeneration)	GW
Heat Plants	PJ/year
Transportation Technologies: Aviation, Rail, Navigation, Non-Energy Uses	PJ/year
Other Transportation Technologies	Billion vehicles-km/year
Industry Technologies: Non-Ferrous, Iron and Steel, Pulp and Paper	Mt/year
Industry Technologies: Chemicals, Non-Metal, Other Industries, Non-Energy	PJ/year
Residential	PJ/year
Commercial	PJ/year
Upstream and Downstream	PJ/year
Emissions	
CO_2 Coefficients	kt CO_2/PJ
CH_4 Coefficients	t CH_4/PJ
N_2O Coefficients	t N_2O/PJ
GHG	Mt CO_2 equivalent
TOTCO2	kt CO_2
Costs	
Energy commodities	M$/PJ ($/GJ)
Variable costs	M$/PJ/year
Investment and fixed operation costs – Power plants and cogeneration	M$/GW
Investment and fixed operation costs – Transportation except aviation, rail, navigation, non-energy uses	M$/bill vehicles-km/year
Investment and fixed operation costs – Technologies other than those above	M$/PJ/year

As a reference, the Table A 2 in Appendix A of this volume contains the complete list of model parameters.

3. Transportation

3.1 Energy services

The transportation sector is characterized by 14 energy services plus one non-energy use demand segment (Table 4). Six of the energy segments are considered as generic demands: international and domestic aviation (TAI, TAD), freight and passengers rail transportation (TTF, TTP), internal and international navigation (TWD, TWI).

Table 4. Transportation energy services

Transportation segments (15)	Codes
Autos	TRT
Buses	TRB
Light trucks	TRL
Commercial trucks	TRC
Medium trucks	TRM
Heavy trucks	TRH
Two wheelers	TRW
Three wheelers	TRE
International aviation	TAI
Domestic aviation	TAD
Freight rail transportation	TTF
Passengers rail transportation	TTP
Internal navigation	TWD
International navigation (bunkers)	TWI
Non-energy uses in transport	NEU

Because the IEA database provides energy consumption estimates for the main transportation modes (road, rail, international and domestic aviation, international and internal navigation), but not for split amongst types of road vehicles or trains the modeler (based on expert judgment and/or specific regional information) provides share estimates to split fuel consumption between road modes and rail modes:

- For road energy use, the analyst provides the needed shares to split fuel consumption first between light-duty vehicles and other road vehicles and second between the different vehicles inside each category: autos, light trucks and two-three wheels on one hand and buses, medium trucks, commercial trucks and heavy trucks on the other hand.
- For the rail mode, the analyst provides the needed shares to split fuel consumption between freight and passengers rail transportation. Table 5 contains sample road and rail transportation end-use breakouts. See Table B 1 to Table B 15, in Appendix B of this volume, for the share of transport modes by fuel in each of the 15 regions.

Table 5. Sample share of transport modes by fuel

	ROAD										RAIL		
	Light Vehicle	TRT	TRL	TRE	TRW	Other Vehicle	TRB	TRH	TRM	TRC	Total	TTF	TTP
TRACOA													
TRAMET	**1.00**	0.47	0.53			**0.00**							
TRAETH	**1.00**	0.03	0.97			**0.00**							
TRANGA	**0.98**	0.52	0.48			**0.02**	0.02	0.05	0.30	0.63			
TRALPG	**0.72**	0.35	0.65			**0.28**	0.02	0.05	0.30	0.63			
TRAGSL	**0.94**	0.58	0.42			**0.06**	0.01	0.04	0.27	0.68			
TRAAVG													
TRAJTK													
TRADST	**0.02**	0.39	0.61			**0.98**	0.04	0.80	0.11	0.05	**1.00**	0.96	0.04

TRAHFO											**1.00**	0.90	0.10
TRAELC	**1.00**	0.66	0.34			**0.00**					**1.00**		1.00

3.2 Projections

Energy service demands are projected to 2025 using general economic and demographic drivers such as population, GDP and GDP per capita) or specific drivers (e.g. traffic in vehicles-kilometers) when alternative estimates are available. The analyst chooses a driver for each service demand (or imports new driver information from Excel). Once the modeler has chosen a driver he/she has to make an assumption concerning the elasticity or sensitivity of service demand in each period to changes in the value of the driver. In the software used to develop SAGE runs (VEDA SAGE), the modeler may choose from a menu of elasticity series or define a new series. The model user 'shapes' the energy service demand forecast based on the choice of these elasticities, a choice that must be based on expert judgment.

See Table B 16 to Table B 30, in Appendix B of this volume, for the projections (to the 2025 horizon) of all energy service demand in each of the 15 regions. The last column of these tables includes the series number of the driver used to project each energy service demand. The drivers used for the reference case are listed and numbered in Table B 31. Furthermore, Table B 32 contains the GDP projections for the reference, high growth and low growth cases.

3.3 Fuels

The IEA database gives consumption information on 21 different fuels, which are aggregated in 11 different categories (methanol and ethanol come from two mixes of fuels each) consumed in the transportation sector (Table 6). Aggregation ratios are based on data provided by the IEA database. The user may decide to change them for future years. Fuels are named uniformly across sectors and regions**.**

Table 6. Technologies created to produce transportation sector fuels

Technology	Description	Commodity IN [a]	Commodity OUT
TRANGA000	Fuel Tech - Natural Gas (TRA)	GASNGA	TRANGA
TRADST000	Fuel Tech – Diesel (TRA)	OILDST	TRADST
TRAGSL000	Fuel Tech - Gasoline (TRA)	OILGSL	TRAGSL
TRAHFO000	Fuel Tech – Heavy Fuel Oil (TRA)	OILHFO OILNSP	TRAHFO
TRACOA000	Fuel Tech - Coal (TRA)	COAHCO COABCO	TRACOA
TRALPG000	Fuel Tech - LPG (TRA)	GASLPG	TRALPG
TRAAVG000	Fuel Tech - Aviation Gasoline (TRA)	OILAVG OILJTG	TRAAVG
TRAJTK000	Fuel Tech - Jet Kerosene (TRA)	OILJTK OILKER	TRAJTK
TRAMET000	Fuel Tech - Methanol (TRA)	BIOLIQ	TRAMET
TRAETH000	Fuel Tech - Ethanol (TRA)	BIOBSL BIOCHR BIOLIQ BIOBMU BIOBIN	TRAETH
TRAMET100	Fuel Tech - Methanol from natural gas (TRA)	GASMET	TRAMET
TRAETH100	Fuel Tech - Ethanol from crop (TRA)	BIOETH	TRAETH
TRAELC000	Fuel Tech - Electricity (TRA)	ELC	TRAELC

[a] See section 7 for description of these commodities.

The technologies created to produce aggregated transportation fuels (Fuel Tech) are named uniformly using the name of the aggregated fuels as specified in the column Commodity OUT plus three zero (000 for existing technology in 2000). Their description changes according to the fuel (e.g. Fuel Tech - Coal (TRA) or Fuel Tech - Natural Gas (TRA). The fractional shares of the disaggregated fuels (Commodity IN) used to produce an aggregated fuel (Commodity OUT) are calculated from their consumption over the total for this category, as given in the IEA database.

3.4 Technologies

3.4.1 Existing technologies

For each end-use, a number of existing technologies are in competition to satisfy the demand (Table 7). They are characterized by an efficiency, an annual utilization factor, a lifetime, and operation costs. No new investments are allowed for existing technologies.

Table 7. Existing technologies in the transportation sector

Technology	Description	Commodity IN
TRT: Autos		
TRTGAS000	CAR: .00.CFV.GAS.EXISTING.STD.	TRAGSL
TRTDST000	CAR: .00.CFV.DST.EXISTING.STD.	TRADST
TRTLPG000	CAR: .00.AFV.LPG.EXISTING.STD.	TRALPG
TRTNGA000	CAR: .00.AFV.NGA.EXISTING.STD.	TRANGA
TRTELC000	CAR: .00.AFV.ELC.EXISTING.STD.	TRAELC
TRTMET000	CAR: .00.AFV.MET.EXISTING.STD.	TRAMET
TRTETH000	CAR: .00.AFV.ETH.EXISTING.STD.	TRAETH
TRB: Buses		
TRBGAS000	BUS: .00.CFV.GAS.EXISTING.STD.	TRAGSL
TRBDST000	BUS: .00.CFV.DST.EXISTING.STD.	TRADST
TRBLPG000	BUS: .00.AFV.LPG.EXISTING.STD.	TRALPG
TRBNGA000	BUS: .00.AFV.NGA.EXISTING.STD.	TRANGA
TRBELC000	BUS: .00.AFV.ELC.EXISTING.STD.	TRAELC
TRBMET000	BUS: .00.AFV.MET.EXISTING.STD.	TRAMET
TRBETH000	BUS: .00.AFV.ETH.EXISTING.STD.	TRAETH
TRL: Light trucks		
TRLGAS000	LIGHT TRUCK: .00.CFV.GAS.EXISTING.STD.	TRAGSL
TRLDST000	LIGHT TRUCK: .00.CFV.DST.EXISTING.STD.	TRADST
TRLLPG000	LIGHT TRUCK: .00.AFV.LPG.EXISTING.STD.	TRALPG
TRLNGA000	LIGHT TRUCK: .00.AFV.NGA.EXISTING.STD.	TRANGA
TRLELC000	LIGHT TRUCK: .00.AFV.ELC.EXISTING.STD.	TRAELC
TRLMET000	LIGHT TRUCK: .00.AFV.MET.EXISTING.STD.	TRAMET
TRLETH000	LIGHT TRUCK: .00.AFV.ETH.EXISTING.STD.	TRAETH
TRC: Commercial trucks		
TRCGAS000	COMMERCIAL TRUCK: .00.CFV.GAS.EXISTING.STD.	TRAGSL
TRCDST000	COMMERCIAL TRUCK: .00.CFV.DST.EXISTING.STD.	TRADST
TRCLPG000	COMMERCIAL TRUCK: .00.AFV.LPG.EXISTING.STD.	TRALPG
TRCNGA000	COMMERCIAL TRUCK: .00.AFV.NGA.EXISTING.STD.	TRANGA
TRCMET000	COMMERCIAL TRUCK: .00.AFV.MET.EXISTING.STD.	TRAMET
TRCETH000	COMMERCIAL TRUCK: .00.AFV.ETH.EXISTING.STD.	TRAETH
TRCGAS000	COMMERCIAL TRUCK: .00.CFV.GAS.EXISTING.STD.	TRAGSL
TRM: Medium trucks		
TRMGAS000	MEDIUM TRUCK: .00.CFV.GAS.EXISTING.STD.	TRAGSL
TRMDST000	MEDIUM TRUCK: .00.CFV.DST.EXISTING.STD.	TRADST
TRMLPG000	MEDIUM TRUCK: .00.AFV.LPG.EXISTING.STD.	TRALPG
TRMNGA000	MEDIUM TRUCK: .00.AFV.NGA.EXISTING.STD.	TRANGA
TRMMET000	MEDIUM TRUCK: .00.AFV.MET.EXISTING.STD.	TRAMET
TRMETH000	MEDIUM TRUCK: .00.AFV.ETH.EXISTING.STD.	TRAETH
TRH: Heavy trucks		
TRHDST000	HEAVY TRUCK: .00.CFV.DST.EXISTING.STD.	TRADST
TRHGAS000	HEAVY TRUCK: .00.CFV.GAS.EXISTING.STD.	TRAGSL
TRHLPG000	HEAVY TRUCK: .00.AFV.LPG.EXISTING.STD.	TRALPG
TRHNGA000	HEAVY TRUCK: .00.AFV.NGA.EXISTING.STD.	TRANGA

Technology	Description	Commodity IN
TRHMET000	HEAVY TRUCK: .00.AFV.MET.EXISTING.STD.	TRAMET
TRHETH000	HEAVY TRUCK: .00.AFV.ETH.EXISTING.STD.	TRAETH
TRW: Two wheelers		
TRWMPG000	MOTOR PED: .00.CFV.GAS.MPG.	TRAGSL
TRWMCG000	MOTOR CYCLE: .00.CFV.GAS.MCG.	TRAGSL
TRE: Three wheelers		
TREGSL000	THREE WHEELS: .00.CFV.GAS.	TRAGSL
TREDST000	THREE WHEELS: .00.CFV.DST.	TRADST
TAI: International aviation		
TAI000	Generic International Aircraft-Existing	TRAJTK, TRAAVG
TAD: Domestic aviation		
TAD000	Generic Domestic Aircraft-Existing	TRAJTK, TRAAVG
TTF: Freight rail transportation		
TTF000	Generic Freight Train-Existing	TRACOA, TRAGSL, TRADST, TRAHFO, TRAELC
TTP: Passengers rail transportation		
TTP000	Generic Passengers Train-Existing	TRACOA, TRAGSL, TRADST, TRAHFO, TRAELC
TWD: Internal navigation		
TWD000	Generic Domestic Navigation Ship Existing	TRADST, TRAHFO, TRACOA, TRAGSL
TWI: International navigation (bunkers)		
TWI000	Generic International Boat-Existing	TRADST, TRAHFO, TRACOA, TRAGSL
NEU: Non-energy uses in transport		
NEU000	Non Energy Uses	OILLUB

3.4.2 New technologies

A SAGE database contains a list of new technologies available after the first period. These technologies progressively replace the existing ones and they are characterized by the same type of parameters such as efficiency, and investment cost (Table 8). Additional new technologies and/or alternative assumptions regarding technology parameter values may used in a SAGE run, and a primary goal of this volume is to arm the analyst with enough information to do exactly that. See the Excel workbook 'TechRep', for the list of new technologies by sector and their parameter values.

Table 8. New technologies in the transportation sector

Technology	Description	Commodity IN
TRT: Autos		
TRTDCA005	CAR: .05.CFV.DST.CAFE.STD.	TRADST
TRTDCA010	CAR: .10.CFV.DST.CAFE.STD.	TRADST
TRTDCA015	CAR: .15.CFV.DST.CAFE.STD.	TRADST
TRTDCA020	CAR: .20.CFV.DST.CAFE.STD.	TRADST
TRTDEG005	CAR: .05.AFV.DEG.ETH/GAS.	TRAETH, TRAGSL
TRTDEG010	CAR: .10.AFV.DEG.ETH/GAS.	TRAETH, TRAGSL
TRTDEG015	CAR: .15.AFV.DEG.ETH/GAS.	TRAETH, TRAGSL
TRTDEG020	CAR: .20.AFV.DEG.ETH/GAS.	TRAETH, TRAGSL
TRTDFL005	CAR: .00.CFV.DST.STD.	TRADST
TRTDMG005	CAR: .05.AFV.DMG.MET/GAS.	TRAMET, TRAGSL
TRTDMG010	CAR: .10.AFV.DMG.MET/GAS.	TRAMET, TRAGSL
TRTDMG015	CAR: .15.AFV.DMG.MET/GAS.	TRAMET, TRAGSL
TRTDMG020	CAR: .20.AFV.DMG.MET/GAS.	TRAMET, TRAGSL
TRTDST005	CAR: .05.CFV.DST.STD.	TRADST
TRTELC005	CAR: .05.AFV.ELC.	TRAELC
TRTELC010	CAR: .10.AFV.ELC.	TRAELC
TRTELC015	CAR: .15.AFV.ELC.	TRAELC
TRTELC020	CAR: .20.AFV.ELC.	TRAELC
TRTETH005	CAR: .05.AFV.ETH.	TRAETH
TRTETH010	CAR: .10.AFV.ETH.	TRAETH
TRTETH015	CAR: .15.AFV.ETH.	TRAETH
TRTETH020	CAR: .20.AFV.ETH.	TRAETH
TRTFUC010	CAR: .10.AFV.FUC.	TRAGSL
TRTFUC015	CAR: .15.AFV.FUC.	TRAGSL
TRTFUC020	CAR: .20.AFV.FUC.	TRAGSL
TRTGAA005	CAR: .00.CFV.GAS.STD.SUBCOMPACT.	TRAGSL
TRTGAB005	CAR: .00.CFV.GAS.STD.COMPACT.	TRAGSL

Technology	Description	Commodity IN
TRTGAC005	CAR: .00.CFV.GAS.STD.MEDIUM.	TRAGSL
TRTGAD005	CAR: .00.CFV.GAS.STD.FULL.	TRAGSL
TRTGAS005	CAR: .05.CFV.GAS.STD.	TRAGSL
TRTGCA005	CAR: .05.CFV.GAS.CAFE.STD.	TRAGSL
TRTGCA010	CAR: .10.CFV.GAS.CAFE.STD.	TRAGSL
TRTGCA015	CAR: .15.CFV.GAS.CAFE.STD.	TRAGSL
TRTGCA020	CAR: .20.CFV.GAS.CAFE.STD.	TRAGSL
TRTGCB005	CAR: .05.CFV.GAS.CAFE.7.0MPG.	TRAGSL
TRTGCB010	CAR: .10.CFV.GAS.CAFE.7.0MPG.	TRAGSL
TRTGCB015	CAR: .15.CFV.GAS.CAFE.7.0MPG.	TRAGSL
TRTGCB020	CAR: .20.CFV.GAS.CAFE.7.0MPG.	TRAGSL
TRTGCC010	CAR: .10.CFV.GAS.CAFE.3.5MPG.	TRAGSL
TRTGCC015	CAR: .15.CFV.GAS.CAFE.3.5MPG.	TRAGSL
TRTGCC020	CAR: .20.CFV.GAS.CAFE.3.5MPG.	TRAGSL
TRTGCE005	CAR: .00.CFV.GAS.CAFE.STD.	TRAGSL
TRTGFL005	CAR: .00.CFV.GAS.STD.	TRAGSL
TRTHYB005	CAR: .05.AFV.HYB.	TRAGSL
TRTHYB010	CAR: .10.AFV.HYB.	TRAGSL
TRTHYB015	CAR: .15.AFV.HYB.	TRAGSL
TRTHYB020	CAR: .20.AFV.HYB.	TRAGSL
TRTLPG005	CAR: .05.AFV.LPG.	TRALPG
TRTLPG010	CAR: .10.AFV.LPG.	TRALPG
TRTLPG015	CAR: .15.AFV.LPG.	TRALPG
TRTLPG020	CAR: .20.AFV.LPG.	TRALPG
TRTMET005	CAR: .05.AFV.MET.	TRAMET
TRTMET010	CAR: .10.AFV.MET.	TRAMET
TRTMET015	CAR: .15.AFV.MET.	TRAMET
TRTMET020	CAR: .20.AFV.MET.	TRAMET
TRTNGA005	CAR: .05.AFV.NGA.	TRANGA
TRTNGA010	CAR: .10.AFV.NGA.	TRANGA
TRTNGA015	CAR: .15.AFV.NGA.	TRANGA
TRTNGA020	CAR: .20.AFV.NGA.	TRANGA
TRB: Buses		
TRBDFL005	BUS: .00.CFV.DST.STD.	TRADST
TRBDSA005	BUS: .05.CFV.DST.10%MPG.	TRADST
TRBDSB005	BUS: .05.CFV.DST.20%MPG.	TRADST
TRBDST005	BUS: .05.CFV.DST.STD.	TRADST
TRBELC005	BUS: .05.AFV.ELC.	TRAELC
TRBETH005	BUS: .05.AFV.ETH.	TRAETH
TRBGAA005	BUS: .05.CFV.GAS.10%MPG.	TRAGSL
TRBGAB005	BUS: .05.CFV.GAS.20%MPG.	TRAGSL
TRBGAS005	BUS: .05.CFV.GAS.STD.	TRAGSL
TRBGFL005	BUS: .00.CFV.GAS.STD.	TRAGSL
TRBLPG005	BUS: .05.AFV.LPG.	TRALPG
TRBMET005	BUS: .05.AFV.MET.	TRAMET
TRBNGA005	BUS: .05.AFV.NGA.	TRANGA
TRL: Light trucks		
TRLDCA005	LIGHT TRUCK: .05.CFV.DST.CAFE.STD.	TRADST
TRLDCA010	LIGHT TRUCK: .10.CFV.DST.CAFE.STD.	TRADST
TRLDCA015	LIGHT TRUCK: .15.CFV.DST.CAFE.STD.	TRADST
TRLDCA020	LIGHT TRUCK: .20.CFV.DST.CAFE.STD.	TRADST
TRLDCB005	LIGHT TRUCK: .05.CFV.DST.CAFE.2MPG.	TRADST
TRLDCB010	LIGHT TRUCK: .10.CFV.DST.CAFE.2MPG.	TRADST
TRLDCB015	LIGHT TRUCK: .15.CFV.DST.CAFE.2MPG.	TRADST
TRLDCB020	LIGHT TRUCK: .20.CFV.DST.CAFE.2MPG.	TRADST
TRLDCC005	LIGHT TRUCK: .05.CFV.DST.CAFE.4MPG.	TRADST
TRLDCC010	LIGHT TRUCK: .10.CFV.DST.CAFE.4MPG.	TRADST
TRLDCC015	LIGHT TRUCK: .15.CFV.DST.CAFE.4MPG.	TRADST
TRLDCC020	LIGHT TRUCK: .20.CFV.DST.CAFE.4MPG.	TRADST
TRLDST005	LIGHT TRUCK: .00.CFV.DST.CAFE.STD.	TRADST
TRLDST010	LIGHT TRUCK: .10.CFV.DST.CAFE.STD.	TRADST
TRLDEG005	LIGHT TRUCK: .05.AFV.DEG.ETH/GAS.	TRAETH, TRAGSL
TRLDEG010	LIGHT TRUCK: .10.AFV.DEG.ETH/GAS.	TRAETH, TRAGSL
TRLDEG015	LIGHT TRUCK: .15.AFV.DEG.ETH/GAS.	TRAETH, TRAGSL
TRLDEG020	LIGHT TRUCK: .20.AFV.DEG.ETH/GAS.	TRAETH, TRAGSL
TRLDMG005	LIGHT TRUCK: .05.AFV.DMG.MET/GAS.	TRAMET, TRAGSL
TRLDMG010	LIGHT TRUCK: .10.AFV.DMG.MET/GAS.	TRAMET, TRAGSL
TRLDMG015	LIGHT TRUCK: .15.AFV.DMG.MET/GAS.	TRAMET, TRAGSL
TRLDMG020	LIGHT TRUCK: .20.AFV.DMG.MET/GAS.	TRAMET, TRAGSL

Technology	Description	Commodity IN
TRLELC005	LIGHT TRUCK: .05.AFV.ELC.	TRAELC
TRLELC010	LIGHT TRUCK: .10.AFV.ELC.	TRAELC
TRLELC015	LIGHT TRUCK: .15.AFV.ELC.	TRAELC
TRLELC020	LIGHT TRUCK: .20.AFV.ELC.	TRAELC
TRLETH005	LIGHT TRUCK: .05.AFV.ETH.	TRAETH
TRLETH010	LIGHT TRUCK: .10.AFV.ETH.	TRAETH
TRLETH015	LIGHT TRUCK: .15.AFV.ETH.	TRAETH
TRLETH020	LIGHT TRUCK: .20.AFV.ETH.	TRAETH
TRLFUE010	LIGHT TRUCK: .10.AFV.FUE.	TRAGSL
TRLFUE015	LIGHT TRUCK: .15.AFV.FUE.	TRAGSL
TRLFUE020	LIGHT TRUCK: .20.AFV.FUE.	TRAGSL
TRLGAA010	LIGHT TRUCK: .10.CFV.GAS.STD.8500LBS.	TRAGSL
TRLGAB010	LIGHT TRUCK: .10.CFV.GAS.IMP.8500LBS.	TRAGSL
TRLGAS005	LIGHT TRUCK: .00.CFV.GAS.STD.	TRAGSL
TRLGCA005	LIGHT TRUCK: .05.CFV.GAS.CAFE.STD.	TRAGSL
TRLGCA010	LIGHT TRUCK: .10.CFV.GAS.CAFE.STD.	TRAGSL
TRLGCA015	LIGHT TRUCK: .15.CFV.GAS.CAFE.STD.	TRAGSL
TRLGCA020	LIGHT TRUCK: .20.CFV.GAS.CAFE.STD.	TRAGSL
TRLGCB005	LIGHT TRUCK: .05.CFV.GAS.CAFE.2MPG.	TRAGSL
TRLGCB010	LIGHT TRUCK: .10.CFV.GAS.CAFE.2MPG.	TRAGSL
TRLGCB015	LIGHT TRUCK: .15.CFV.GAS.CAFE.2MPG.	TRAGSL
TRLGCB020	LIGHT TRUCK: .20.CFV.GAS.CAFE.2MPG.	TRAGSL
TRLGCC005	LIGHT TRUCK: .05.CFV.GAS.CAFE.4MPG.	TRAGSL
TRLGCC010	LIGHT TRUCK: .10.CFV.GAS.CAFE.4MPG.	TRAGSL
TRLGCC015	LIGHT TRUCK: .15.CFV.GAS.CAFE.4MPG.	TRAGSL
TRLGCC020	LIGHT TRUCK: .20.CFV.GAS.CAFE.4MPG.	TRAGSL
TRLGCD005	LIGHT TRUCK: .00.CFV.GAS.CAFE.STD.	TRAGSL
TRLHYB010	LIGHT TRUCK: .10.AFV.HYB.	TRAGSL
TRLHYB015	LIGHT TRUCK: .15.AFV.HYB.	TRAGSL
TRLHYB020	LIGHT TRUCK: .20.AFV.HYB.	TRAGSL
TRLLPG005	LIGHT TRUCK: .05.AFV.LPG.	TRALPG
TRLLPG010	LIGHT TRUCK: .10.AFV.LPG.	TRALPG
TRLLPG015	LIGHT TRUCK: .15.AFV.LPG.	TRALPG
TRLLPG020	LIGHT TRUCK: .20.AFV.LPG.	TRALPG
TRLMET005	LIGHT TRUCK: .05.AFV.MET.	TRAMET
TRLMET010	LIGHT TRUCK: .10.AFV.MET.	TRAMET
TRLMET015	LIGHT TRUCK: .15.AFV.MET.	TRAMET
TRLMET020	LIGHT TRUCK: .20.AFV.MET.	TRAMET
TRLNGA005	LIGHT TRUCK: .05.AFV.NGA.	TRANGA
TRLNGA010	LIGHT TRUCK: .10.AFV.NGA.	TRANGA
TRLNGA015	LIGHT TRUCK: .15.AFV.NGA.	TRANGA
TRLNGA020	LIGHT TRUCK: .20.AFV.NGA.	TRANGA
TRC: Commercial trucks		
TRCDST005	COMMERCIAL TRUCK: .05.CFV.DST.STD.	TRADST
TRCETH005	COMMERCIAL TRUCK: .05.AFV.ETH.	TRAETH
TRCGAS005	COMMERCIAL TRUCK: .05.CFV.GAS.STD.	TRAGSL
TRCLPG005	COMMERCIAL TRUCK: .05.AFV.LPG.	TRALPG
TRCMET005	COMMERCIAL TRUCK: .05.AFV.MET.	TRAMET
TRCNGA005	COMMERCIAL TRUCK: .05.AFV.NGA.	TRANGA
TRCDST005	COMMERCIAL TRUCK: .05.CFV.DST.STD.	TRADST
TRM: Medium trucks		
TRMDST005	MEDIUM TRUCK: .05.CFV.DST.STD.	TRADST
TRMETH005	MEDIUM TRUCK: .05.AFV.ETH.	TRAETH
TRMGAS005	MEDIUM TRUCK: .05.CFV.GAS.STD.	TRAGSL
TRMLPG005	MEDIUM TRUCK: .05.AFV.LPG.	TRALPG
TRMMET005	MEDIUM TRUCK: .05.AFV.MET.	TRAMET
TRMNGA005	MEDIUM TRUCK: .05.AFV.NGA.	TRANGA
TRH: Heavy trucks		
TRHDFL005	HEAVY TRUCK: .05.CFV.DST.STD.	TRADST
TRHDSA005	HEAVY TRUCK: .05.CFV.DST.10%MPG.	TRADST
TRHDSA010	HEAVY TRUCK: .10.CFV.DST.10%MPG.	TRADST
TRHDSA015	HEAVY TRUCK: .15.CFV.DST.10%MPG.	TRADST
TRHDSA020	HEAVY TRUCK: .20.CFV.DST.10%MPG.	TRADST
TRHDSB005	HEAVY TRUCK: .05.CFV.DST.15%MPG.	TRADST
TRHDSB010	HEAVY TRUCK: .10.CFV.DST.15%MPG.	TRADST
TRHDSB015	HEAVY TRUCK: .15.CFV.DST.15%MPG.	TRADST
TRHDSB020	HEAVY TRUCK: .20.CFV.DST.15%MPG.	TRADST
TRHDST005	HEAVY TRUCK: .00.CFV.DST.STD.	TRADST

Technology	Description	Commodity IN
TRHDST010	HEAVY TRUCK: .10.CFV.DST.STD.	TRADST
TRHDST015	HEAVY TRUCK: .15.CFV.DST.STD.	TRADST
TRHDST020	HEAVY TRUCK: .20.CFV.DST.STD.	TRADST
TRHETH005	HEAVY TRUCK: .05.AFV.ETH.	TRAETH
TRHETH010	HEAVY TRUCK: .10.AFV.ETH.	TRAETH
TRHETH015	HEAVY TRUCK: .15.AFV.ETH.	TRAETH
TRHETH020	HEAVY TRUCK: .20.AFV.ETH.	TRAETH
TRHGAS005	HEAVY TRUCK: .05.CFV.GAS.STD.	TRAGSL
TRHGFL005	HEAVY TRUCK: .00.CFV.GAS.STD.	TRAGSL
TRHLPG005	HEAVY TRUCK: .05.AFV.LPG.	TRALPG
TRHLPG010	HEAVY TRUCK: .10.AFV.LPG.	TRALPG
TRHLPG015	HEAVY TRUCK: .15.AFV.LPG.	TRALPG
TRHLPG020	HEAVY TRUCK: .20.AFV.LPG.	TRALPG
TRHMET005	HEAVY TRUCK: .05.AFV.MET.	TRAMET
TRHMET010	HEAVY TRUCK: .10.AFV.MET.	TRAMET
TRHMET015	HEAVY TRUCK: .15.AFV.MET.	TRAMET
TRHMET020	HEAVY TRUCK: .20.AFV.MET.	TRAMET
TRHNGA005	HEAVY TRUCK: .05.AFV.NGA.	TRANGA
TRHNGA010	HEAVY TRUCK: .10.AFV.NGA.	TRANGA
TRHNGA015	HEAVY TRUCK: .15.AFV.NGA.	TRANGA
TRHNGA020	HEAVY TRUCK: .20.AFV.NGA.	TRANGA
TRW: Two wheelers		
TRWMCG005	MOTOR CYCLE: .05.CFV.GAS.MCG.	TRAGSL
TRWMPG005	MOTOR PED: .05.CFV.GAS.MPG.	TRAGSL
TRE: Three wheelers		
TREDST005	THREE WHEELS: .05.CFV.DST.	TRADST
TREGSL005	THREE WHEELS: .05.CFV.GAS.	TRAGSL

3.4.3 Technology naming conventions

The existing and the new technologies are always identified with a nine-character code (e.g. TRLGAS000, TRLDST005):

- The first three letters refer to the end-use code, such as 'TRL' for light trucks and 'TRB' for buses.
- The next three letters are related to the fuel consumed by the technology, such as 'DST' for diesel and 'GSL' for gasoline. Because there are many technologies, some variants are used to avoid repeated codes, for instance anything beginning with G* for gasoline or with D* for diesel.
- The last three digits refer to the year of the technology's first availability, such as '000' for 2000 and '005' for 2005.

The description of the existing technologies (e.g. CAR: .00.CFV.GAS.EXISTING.STD.) contains:

- The type of the technology followed by a colon such as (CAR:).
- The year of availability, which is always (.00.) for 2000.
- The category of the technology, that is Conventional Fuel Vehicles (.CFV.) or Alternative Fuel Vehicles (.AFV.). Conventional fuels are gasoline and diesel. Alternative fuels are LPG, ethanol, natural gas, methanol and electricity.
- The fuel consumed, such as (.GAS.) for gasoline.
- The existing characterization (.EXISTING.)
- The efficiency, which is always standard (.STD.).

The new technologies have been described in a uniform way to facilitate the creation of user defined market share constraints (e.g. LIGHT TRUCK: .00.CFV.DST.CAFE.STD). Different

sections of the description are the dimensions along which the modeler may want to constrain technology market penetration. The description contains:

- The type of technologies followed by a column, such as (LIGHT TRUCK:).
- The year of availability, such as (.05.) for 2005.
- The category of technology, that is Conventional Fuel Vehicles (.CFV.) or Alternative Fuel Vehicles (.AFV.).
- The fuel consumption, such as (.DST.) for diesel.
- The efficiency that is standard (.STD.) or improved according to the Corporate Average Fuel Economy norms (.CAFE.).
- Other particularities, like the size of the cars (.COMPACT.) or the detail of the CAFE norms, which can be standards (.STD.) or more efficient in terms of miles per gallon (.7.0MPG.).

There are no new technologies associated with generic demands (TAI: International aviation, TAD: Domestic aviation, TTF: Freight rail transportation, TTP: Passengers rail transportation, TWD: Internal navigation, TWI: International navigation (bunkers) and non-energy uses in transport (NEU).

3.5 User-defined technology market share parameters and constraints

Because SAGE provides projections of energy use for publication in the *International Energy Outlook* the reference case, must reflect analysts' best judgment of evolving technology markets. And because SAGE is also used as a policy analysis tool it must be capable of endogenously determining technology market shares to reflect the effects of alternative policies. SAGE has two mechanisms for affecting investments in new technologies—one based on the *endogenously calculated relative costs* of providing service to a particular energy market (e.g. personal travel in cars) and another that reflects *exogenous expert judgment.*

3.5.1 Relative Endogenous Cost of Service

As discussed in Volume 1 (section 3.2.4) the analyst may develop technology market share estimates either based on the technology's (or group of technology's) relative cost of providing an energy service or energy carrier. For example, many conventional and renewable technologies are included in a SAGE database. Based on energy resource and technology cost assumptions, one technology alone, say a natural gas fired combined cycle unit, may represent the least cost means of producing electricity and gain 100-percent of the market for generating electricity. Such a result, however, would be at odds with observed market behavior for many reasons. For example, the level of geographic aggregation may mask significant intra-regional differences in resource availability and technology cost, and profit maximization may not be the sole motivating factor determining investment behavior.

SAGE has been designed with greater parametric control over technology choice specifically to prevent a single technology (the one with the smallest annualized cost) from winning the whole market. It allows multiple technologies to capture some market share, by setting up suitably derived market share constraints. To let relative cost of service guide market share decisions s the modeler must provide parameter values indicating among other things the degree to which costs should guide decisions and the percentage share that should be reallocated to other technologies whose costs are 'close enough' (the user defines how close is close enough) to the least cost technology.

3.5.2 Exogenous Expert Judgment

Three levels of user constraints (are used to characterize market behavior in the transportation sector, in order to avoid abrupt and improbable technology market changes based on factors outside the scope of this model. Note that these constraints are progressively relaxed in future periods. Stars (*) function as wild cards (see description of new technologies):

- The first level controls the share between Conventional Fuel Vehicles (*.CFV.*) and Alternative Fuel Vehicles (*.AFV.*) in each end-use. Conventional fuels are: gasoline and diesel; alternate are: LPG, ethanol, natural gas, methanol, electricity, and hydrogen.
    - S_TRT_CFV: Conventional autos as a share of total autos
- The second level controls the relative consumption of each fuel, such as (*.GAS.*) or (*.ELC.*), inside each of the two categories (conventional and alternative).
    - S_TRT_GSL: Gasoline autos as share of conventional.
- The third level controls the penetration of technologies with different efficiencies within each fuel type, for instance for the conventional gasoline autos (*.CAFE.3.5MPG.*) or (*.STD.*).
    - S_TRT_GCA: Autos with standard efficiency

Note all energy services do not necessarily have three levels of user-defined constraints. See in the appendix to this volume for the complete list of user-defined constraints in the transportation sector and their descriptions.

4. Residential, Commercial and Agriculture

4.1 Energy Services

The residential sector includes 11 energy services, the commercial sector includes 8 segments and the agriculture sector includes 1 segment (Table 9). In residential and commercial sectors, some segments are identified using more than one code, which means that the demand can be disaggregated in four or less sub-regions. Currently, THE US and Canada have four and three geographic regions, respectively, while Mexico, China and India each have two 'sub-regions', corresponding to rural and urban areas. When no sub-regions have been defined, the codes for sub-region 1 are used by default (RH1, CH1, RL1, RK1, CH1, CC1). The agriculture sector is represented using a single generic demand.

Table 9. Residential, commercial and agriculture segments

Residential segments (11)	Codes	Commercial segments (8)	Codes
Space heating	RH1, RH2, RH3, RH4	Space heating	CH1, CH2. CH3, CH4
Space cooling	RC1, RC2, RC3, RC4	Space cooling	CC1, CC2. CC3. CC4
Hot water heating	RWH	Hot water heating	CHW
Lighting	RL1, RL2, RL3, RL4	Lighting	CLA
Cooking	RK1, RK2, RK3, RK4	Cooking	CCK
Refrigerators and freezers	RRF	Refrigerators and freezers	CRF
Cloth washers	RCW	Electric equipments	COE
Cloth dryers	RCD	Other energy uses	COT
Dish washers	RDW		
Miscellaneous electric energy	REA	**Agriculture segments (1)**	**Codes**
Other energy uses	ROT	Agriculture	AGR

Because neither the IEA Energy Balances nor any other comprehensive database provides data at the energy service level, expert judgment is used to define the split of fuel consumption between end-use service demands. In some regions, this expert judgment can be linked solidly to specific country or region level surveys and studies. In other regions, it may be possible to make inferences based on another region's information. At any rate, not disaggregating fuel consumption by energy service would implicitly assume that all energy services can be met equally well by any fuel. Obviously, electricity may substitute for distillate fuel oil in residential heating, but the reverse is not true. Table 10 shows a sample residential sector breakout. A region may be disaggregated to up to four sub regions for space conditioning, lighting, and cooking service demands. Table 11 shows a sample regional breakout for residential space heating.

See Table B 33 to Table B 47, in Appendix B of this volume, for the share of residential end-uses by fuel in each of the 15 regions, and Table B 48 to Table B 62 for the share of commercial end-uses by fuel.

Table 10. Sample share of residential end-uses by fuel

	RH1	RC1	RHW	RRF	RCD	RK1	RCW	RDW	ROT	REA	RL1	Total
RESNGA	0.66	0.00	0.26		0.01	0.04			0.02			1.00
RESDST	0.84		0.16									1.00
RESHFO	1.00											1.00
RESKER	1.00											1.00
RESCOA	1.00											1.00
RESLPG	0.68		0.23			0.07			0.02			1.00
RESBIO	1.00											1.00
RESELC	0.10	0.14	0.10	0.14	0.06	0.03	0.01	0.01		0.33	0.09	1.00
RESHET												
RESGEO	0.87	0.13										1.00
RESSOL			1.00									1.00

Table 11. Sample regional breakout of residential space heating

	Northeast	South	Midwest	West	Total
RESNGA	0.22	0.17	0.42	0.18	**1.00**
RESDST	0.72	0.13	0.11	0.04	**1.00**
RESHFO					
RESKER	0.39	0.37	0.22	0.02	**1.00**
RESCOA	0.27	0.26	0.32	0.15	**1.00**
RESLPG	0.08	0.36	0.47	0.10	**1.00**
RESBIO	0.28	0.29	0.17	0.26	**1.00**
RESELC	0.11	0.49	0.15	0.26	**1.00**
RESHET					
RESGEO	0.16	0.21	0.56	0.07	**1.00**
RESSOL					

4.2 Projections

Same methodology as described in section 3.2 for the transportation sector. See Table B 16 to Table B 32, in Appendix B of this volume.

4.3 Fuels

The IEA database gives consumption information on 22 different fuels, which SAGE aggregates into 11 different categories consumed in the residential and the commercial sectors (Table 12). The fuels are aggregated into 12 categories consumed in the agriculture sector (Table 13). Aggregation ratios are based on data provided by the IEA database. The user may decide to change them for future years. Fuels are named uniformly across sectors.

Table 12. Technologies created to produce residential sector fuels[a]

Technology	Description	Commodity IN (*)	Commodity OUT
RESNGA000	Fuel Tech - Natural Gas (RES)	GASNGA GASGWG GASCOG	RESNGA
RESDST000	Fuel Tech - Diesel (RES)	OILDST OILGSL OILNSP	RESDST
RESHFO000	Fuel Tech - Heavy Fuel Oil (RES)	OILHFO OILCRD	RESHFO
RESKER000	Fuel Tech - Kerosene (RES)	OILKER	RESKER
RESCOA000	Fuel Tech - Coal (RES)	COAHCO COABCO COAOVC	RESCOA
RESLPG000	Fuel Tech - LPG (RES)	GASLPG	RESLPG
RESBIO000	Fuel Tech - Biofuels (RES)	BIOBSL BIOCHR BIOGAS BIOBMU BIOBIN	RESBIO
RESGEO000	Fuel Tech - Geothermal (RES)	GEO	RESGEO
RESSOL000	Fuel Tech - Solar (RES)	SOL	RESSOL
RESELC000	Fuel Tech - Electricity (RES)	ELC	RESELC
RESHET000	Fuel Tech - Heat (RES)	HET	RESHET

[a] See section 7 for description of these commodities.

* The same procedure is used in the commercial sector. The technology and the aggregated fuels are named used the first three letters COM instead of RES.

Table 13. Technologies created to produce agriculture sector fuels

Technology	Description	Commodity IN [a]	Commodity OUT
AGRNGA000	Fuel Tech - Natural Gas (AGR)	GASNGA GASGWG GASCOG	AGRNGA
AGRDST000	Fuel Tech - Diesel (AGR)	OILDST OILNSP	AGRDST
AGRGSL000	Fuel Tech - Gasoline (AGR)	OILGSL	AGRGSL
AGRHFO000	Fuel Tech - Heavy Fuel Oil (AGR)	OILHFO OILCRD	AGRHFO
AGRKER000	Fuel Tech - Kerosene (AGR)	OILKER	AGRKER
AGRCOA000	Fuel Tech - Coal (AGR)	COAHCO COABCO COAOVC	AGRCOA
AGRLPG000	Fuel Tech - LPG (AGR)	GASLPG	AGRLPG
AGRBIO000	Fuel Tech - Biofuels (AGR)	BIOBSL BIOCHR BIOGAS BIOBMU BIOBIN	AGRBIO
AGRGEO000	Fuel Tech - Geothermal (AGR)	GEO	AGRGEO
AGRSOL000	Fuel Tech - Solar (AGR)	SOL	AGRSOL
AGRELC000	Fuel Tech - Electricity (AGR)	ELC	AGRELC
AGRHET000	Fuel Tech - Heat (AGR)	HET	AGRHET

[a] See section 7 for description of these commodities.

The technologies created to produce aggregated fuels (Fuel Tech) are named uniformly using the name of the aggregated fuels as specified in the column Commodity OUT plus three zero (000 for existing technology in 2000). Their description changes according to the fuel (e.g. Fuel Tech - Coal (RES) or Fuel Tech - Natural Gas (RES). The fractional shares of the disaggregated fuels (Commodity IN) used to produce an aggregated fuel (Commodity OUT) are calculated from their consumption over the total for this category, as given in the IEA database.

4.4 Technologies

4.4.1 Existing technologies

For each end-use energy service, a number of existing technologies are in competition to satisfy the demand (Table 14). They are characterized by an efficiency, an annual utilization factor, a lifetime, operation costs, and six seasonal share coefficients (summer-day, summer-night, intermediary-day, intermediary-night, winter-day, winter-night). No future investment is allowed in the existing technologies.

Table 14. Existing technologies in the residential, commercial and agriculture sectors

Technology	Description	Commodity IN
RH1, RH2, RH3, RH4: Space heating		
RH1NGA000	RES.HEAT.R1: .00.NGA.INS-REG.BURNER.STD.	RESNGA
RH1NHP000	RES.HEAT.R1: .00.NGA.INS-REG.HEAT PUMP.AIR.STD.	RESNGA
RH1DST000	RES.HEAT.R1: .00.DST.INS-REG.BURNER.IMP.	RESDST
RH1HFO000	RES.HEAT.R1: .00.HFO.INS-REG.BURNER.	RESHFO
RH1KER000	RES.HEAT.R1: .00.KER.INS-REG.BURNER.	RESKER
RH1COA000	RES.HEAT.R1: .00.COA.INS-REG.BURNER.	RESCOA
RH1LPG000	RES.HEAT.R1: .00.LPG.INS-REG.BURNER.	RESLPG
RH1BIO000	RES.HEAT.R1: .00.BIO.INS-REG.WOODSTOVES.	RESBIO
RH1ERS000	RES.HEAT.R1: .00.ELC.INS-REG.RESISTANCE.	RESELC
RH1EHP000	RES.HEAT.R1: .00.ELC.INS-REG.HEAT PUMP.AIR.STD.	RESELC
RH1HET000	RES.HEAT.R1: .00.HET.INS-REG.EXCHANGER.	RESHET
RH1GEO000	RES.HEAT.R1: .00.GEO.INS-REG.HEAT PUMP.GROUND.STD.	RESGEO
RC1, RC2, RC3, RC4: Space cooling		
RC1NHP000	RES.COOL.R1: .00.NGA.INS-REG.HEAT PUMP.AIR.STD.	RESNGA
RC1GEO000	RES.COOL.R1: .00.GEO.INS-REG.HEAT PUMP.GROUND.STD.	RESGEO
RC1CAE000	RES.COOL.R1: .00.ELC.INS-REG.CENTRAL.STD.	RESELC
RC1EHP000	RES.COOL.R1: .00.ELC.INS-REG.HEAT PUMP.AIR.STD.	RESELC
RC1RAE000	RES.COOL.R1: .00.ELC.INS-REG.ROOM.STD.	RESELC
RHW: Hot water heating		
RHWNGA000	RES: .00.NGA.WATER HEATER.STD.	RESNGA
RHWDST000	RES: .00.DST.WATER HEATER.STD.	RESDST
RHWKER000	RES: .00.KER.WATER HEATER.STD.	RESKER
RHWCOA000	RES: .00.COA.WATER HEATER.STD.	RESCOA
RHWLPG000	RES: .00.LPG.WATER HEATER.STD.	RESLPG
RHWBIO000	RES: .00.BIO.WATER HEATER.STD.	RESBIO
RHWELC000	RES: .00.ELC.WATER HEATER.STD.	RESELC
RHWSOL000	RES: .00.SOL.WATER HEATER.STD.	RESSOL
RL1, RL2, RL3, RL4: Lighting		
RL1KER000	RES.LIGH.R1: .00.KER.LAMP.	RESKER
RL1ICE000	RES.LIGH.R1: .00.ELC.INCANDESCENT.STD.	RESELC
RL1HAE000	RES.LIGH.R1: .00.ELC.HALOGEN.	RESELC
RL1FLE000	RES.LIGH.R1: .00.ELC.FLUORESCENT.BASELINE.	RESELC
RL1CFL000	RES.LIGH.R1: .00.ELC.FLUO.LAMP.COMPACT.	RESELC
RK1, RK2, RK3, RK4: Cooking		
RK1NGA000	RES.COOK.R1: .00.NGA.	RESNGA
RK1KER000	RES.COOK.R1: .00.KER.	RESKER
RK1COA000	RES.COOK.R1: .00.COA.	RESCOA
RK1LPG000	RES.COOK.R1: .00.LPG.	RESLPG
RK1ELC000	RES.COOK.R1: .00.ELC.	RESELC
RK1BIO000	RES.COOK.R1: .00.BIO.	RESBIO
RK1SOL000	RES.COOK.R1: .00.SOL.	RESSOL
RRF: Refrigerators and freezers		
RRFRFE000	RES: .00.ELC.REFRIGERATORS.STD.	RESELC
RRFFRE000	RES: .00.ELC.FREEZERS.STD.	RESELC
RCW: Cloth washers		
RCWELC000	RES: .00.ELC.CLOTH WASHING.STD.	RESELC
RCD: Cloth dryers		
RCDNGA000	RES: .00.NGA.CLOTH DRIERS.STD.	RESNGA
RCDELC000	RES: .00.ELC.CLOTH DRIERS.STD.	RESELC
RDW Dish washers		
RDWELC000	RES: .00.ELC.DISH WASHER.STD.	RESELC
REA: Miscellaneous electric energy		
REAELC000	RES: .00.ELC.EQUIPMENT.MISCELLANEOUS.	RESELC

Technology	Description	Commodity IN
ROT: Other energy uses		
ROTDST000	RES: .00.DST.EQUIPMENT.OTHERS.	RESDST
ROTHFO000	RES: .00.HFO.EQUIPMENT.OTHERS.	RESHFO
ROTKER000	RES: .00.KER.EQUIPMENT.OTHERS.	RESKER
ROTCOA000	RES: .00.COA.EQUIPMENT.OTHERS.	RESCOA
ROTGEO000	RES: .00.GEO.EQUIPMENT.OTHERS.	RESGEO
ROTSOL000	RES: .00.SOL.EQUIPMENT.OTHERS.	RESSOL
ROTBIO000	RES: .00.BIO.EQUIPMENT.OTHERS.	RESBIO
ROTHET000	RES: .00.HET.EQUIPMENT.OTHERS.	RESHET
ROTLPG000	RES: .00.LPG.EQUIPMENT.OTHERS.	RESLPG
ROTNGA000	RES: .00.NGA.EQUIPMENT.OTHERS.	RESNGA
CH1, CH2. CH3, CH4: Space heating		
CH1NFN000	COM.HEAT.R1: .00.NGA.BURNER.STD.	COMNGA
CH1NHP000	COM.HEAT.R1: .00.NGA.HEAT PUMP.STD.	COMNGA
CH1DST000	COM.HEAT.R1: .00.DST.BURNER.STD.	COMDST
CH1HFO000	COM.HEAT.R1: .00.HFO.BOILER.STD.	COMHFO
CH1KER000	COM.HEAT.R1: .00.KER.	COMKER
CH1COA000	COM.HEAT.R1: .00.COA.BURNER.	COMCOA
CH1LPG000	COM.HEAT.R1: .00.LPG.	COMLPG
CH1BIO000	COM.HEAT.R1: .00.BIO.BURNER.	COMBIO
CH1ERS000	COM.HEAT.R1: .00.ELC.RESISTANCE.	COMELC
CH1EHP000	COM.HEAT.R1: .00.ELC.HEAT PUMP.AIR.STD.	COMELC
CH1HET000	COM.HEAT.R1: .00.HET.EXCHANGER.	COMHET
CH1GEO000	COM.HEAT.R1: .00.GEO.EXCHANGER.	COMGEO
CC1, CC2. CC3. CC4: Space cooling		
CC1NGA000	COM.COOL.R1: .00.NGA.CHILLER.ABSORPTION.	COMNGA
CC1DST000	COM.COOL.R1: .00.DST.CHILLER.	COMDST
CC1GEO000	COM.COOL.R1: .00.GEO.HEAT PUMP.IMP.	COMGEO
CC1CAE000	COM.COOL.R1: .00.ELC.CENTRAL.	COMELC
CC1EHP000	COM.COOL.R1: .00.ELC.HEAT PUMP.AIR.STD.	COMELC
CC1RAE000	COM.COOL.R1: .00.ELC.ROOM.	COMELC
CC1ECE000	COM.COOL.R1: .00.ELC.CHILLER.ROOFTOP.STD.	COMELC
CHW: Hot water heating		
CHWNGA000	COM: .00.NGA.WATER HEATER.STD.	COMNGA
CHWDST000	COM: .00.DST.WATER HEATER.STD.	COMDST
CHWKER000	COM: .00.KER.WATER HEATER.STD.	COMKER
CHWHFO000	COM: .00.HFO.WATER HEATER.STD.	COMHFO
CHWCOA000	COM: .00.COA.WATER HEATER.STD.	COMCOA
CHWLPG000	COM: .00.LPG.WATER HEATER.STD.	COMLPG
CHWELC000	COM: .00.ELC.WATER HEATER.STD.	COMELC
CHWSOL000	COM: .00.SOL.WATER HEATER.STD.	COMSOL
CLA: Lighting		
CLAKER000	COM.LIGH: .00.KER.LAMP.	COMKER
CLAICE000	COM.LIGH: .00.ELC.INCANDESCENT.	COMELC
CLAHAE000	COM.LIGH: .00.ELC.HALOGEN.	COMELC
CLAHID000	COM.LIGH: .00.ELC.MERCURY.	COMELC
CLAFLE000	COM.LIGH: .00.ELC.FLUORESCENT.BASELINE.	COMELC
CLACFL000	COM.LIGH: .00.ELC.FLUO.LAMP.COMPACT.	COMELC
CCK: Cooking		
CCKNGA000	COM: .00.NGA.COOKING.	COMNGA
CCKKER000	COM: .00.KER.COOKING.	COMKER
CCKLPG000	COM: .00.LPG.COOKING.	COMLPG
CCKCOA000	COM: .00.COA.COOKING.	COMCOA
CCKBIO000	COM: .00.BIO.COOKING.	COMBIO
CCKELC000	COM: .00.ELC.COOKING.	COMELC
CRF: Refrigerators and freezers		
CRFELC000	COM: .00.ELC.REFRIGERATORS.	COMELC
COE: Electric equipments		
COEELC000	COM: .00.ELC.EQUIPMENT.OTHERS.	COMELC
COT: Other energy uses		
COTELC000	COM: .00.ELC.EQUIPMENT.OTHERS.	COMELC
COTDST000	COM: .00.DST.EQUIPMENT.OTHERS.	COMDST
COTNGA000	COM: .00.NGA.EQUIPMENT.OTHERS.	COMNGA
AGR: Agriculture		
AGR000	Agriculture Existing	AGRNGA, AGRDST, AGRGSL, AGRHFO, AGRKER, AGRCOA, AGRLPG, AGRBIO, AGRELC, AGRHET, AGRGEO, AGRSOL

4.4.2 New technologies

A SAGE database contains a list of new technologies, available after the first period. These technologies progressively replace existing technologies as they wear out according to technology life assumptions (Table 15). In addition to parameters specified for existing technologies, new technology descriptions include information such as technology cost. See the Excel workbook 'TechRep', for the list of new technologies by sector and their parameter values.

Table 15. New technologies in the residential, commercial and agriculture sectors

Technology	Description	Commodity IN
RH1, RH2, RH3, RH4: Space heating		
RH1BIO005	RES.HEAT.R1: .05.BIO.INS-REG.WOODSTOVES.	RESBIO
RH1BIO105	RES.HEAT.R1: .05.BIO.INS-35%.WOODSTOVES.	RESBIO
RH1BIO205	RES.HEAT.R1: .05.BIO.INS-47%.WOODSTOVES.	RESBIO
RH1BIO305	RES.HEAT.R1: .05.BIO.INS-50%.WOODSTOVES.	RESBIO
RH1COA005	RES.HEAT.R1: .05.COA.INS-REG.BURNER.	RESCOA
RH1COA105	RES.HEAT.R1: .05.COA.INS-35%.BURNER.	RESCOA
RH1COA205	RES.HEAT.R1: .05.COA.INS-47%.BURNER.	RESCOA
RH1COA305	RES.HEAT.R1: .05.COA.INS-50%.BURNER.	RESCOA
RH1DSA005	RES.HEAT.R1: .05.DST.INS-REG.BURNER.IMP.	RESDST
RH1DSA105	RES.HEAT.R1: .05.DST.INS-35%.BURNER.IMP.	RESDST
RH1DSA205	RES.HEAT.R1: .05.DST.INS-47%.BURNER.IMP.	RESDST
RH1DSA305	RES.HEAT.R1: .05.DST.INS-50%.BURNER.IMP.	RESDST
RH1DSB005	RES.HEAT.R1: .05.DST.INS-REG.BURNER.NEW.	RESDST
RH1DSB105	RES.HEAT.R1: .05.DST.INS-35%.BURNER.NEW.	RESDST
RH1DSB205	RES.HEAT.R1: .05.DST.INS-47%.BURNER.NEW.	RESDST
RH1DSB305	RES.HEAT.R1: .05.DST.INS-50%.BURNER.NEW.	RESDST
RH1DSO005	RES.HEAT.R1: .05.DST.INS-REG.SOLAR.	RESDST
RH1DSO105	RES.HEAT.R1: .05.DST.INS-35%.SOLAR.	RESDST
RH1DSO205	RES.HEAT.R1: .05.DST.INS-47%.SOLAR.	RESDST
RH1DSO305	RES.HEAT.R1: .05.DST.INS-50%.SOLAR.	RESDST
RH1DST005	RES.HEAT.R1: .05.DST.INS-REG.BURNER.STD.	RESDST
RH1DST105	RES.HEAT.R1: .05.DST.INS-35%.BURNER.STD.	RESDST
RH1DST205	RES.HEAT.R1: .05.DST.INS-47%.BURNER.STD.	RESDST
RH1DST305	RES.HEAT.R1: .05.DST.INS-50%.BURNER.STD.	RESDST
RH1EHP005	RES.HEAT.R1: .05.ELC.INS-REG.HEAT PUMP.AIR.STD.	RESELC
RH1EHP105	RES.HEAT.R1: .05.ELC.INS-35%.HEAT PUMP.AIR.STD.	RESELC
RH1EHP205	RES.HEAT.R1: .05.ELC.INS-47%.HEAT PUMP.AIR.STD.	RESELC
RH1EHP305	RES.HEAT.R1: .05.ELC.INS-50%.HEAT PUMP.AIR.STD.	RESELC
RH1ELB005	RES.HEAT.R1: .05.ELC.INS-REG.HEAT PUMP.AIR.IMP.	RESELC
RH1ELB105	RES.HEAT.R1: .05.ELC.INS-35%.HEAT PUMP.AIR.IMP.	RESELC
RH1ELB205	RES.HEAT.R1: .05.ELC.INS-47%.HEAT PUMP.AIR.IMP.	RESELC
RH1ELB305	RES.HEAT.R1: .05.ELC.INS-50%.HEAT PUMP.AIR.IMP.	RESELC
RH1ELD005	RES.HEAT.R1: .05.ELC.INS-REG.HEAT PUMP.AIR.ADV.	RESELC
RH1ELD105	RES.HEAT.R1: .05.ELC.INS-35%.HEAT PUMP.AIR.ADV.	RESELC
RH1ELD205	RES.HEAT.R1: .05.ELC.INS-47%.HEAT PUMP.AIR.ADV.	RESELC
RH1ELD305	RES.HEAT.R1: .05.ELC.INS-50%.HEAT PUMP.AIR.ADV.	RESELC
RH1ELF005	RES.HEAT.R1: .05.GEO.INS-REG.HEAT PUMP.GROUND.STD.	RESGEO
RH1ELF105	RES.HEAT.R1: .05.GEO.INS-35%.HEAT PUMP.GROUND.STD.	RESGEO
RH1ELF205	RES.HEAT.R1: .05.GEO.INS-47%.HEAT PUMP.GROUND.STD.	RESGEO
RH1ELF305	RES.HEAT.R1: .05.GEO.INS-50%.HEAT PUMP.GROUND.STD.	RESGEO
RH1ELS005	RES.HEAT.R1: .05.ELC.INS-REG.SOLAR.	RESELC
RH1ELS105	RES.HEAT.R1: .05.ELC.INS-35%.SOLAR.	RESELC
RH1ELS205	RES.HEAT.R1: .05.ELC.INS-47%.SOLAR.	RESELC
RH1ELS305	RES.HEAT.R1: .05.ELC.INS-50%.SOLAR.	RESELC
RH1ERS005	RES.HEAT.R1: .05.ELC.INS-REG.RESISTANCE.	RESELC
RH1ERS105	RES.HEAT.R1: .05.ELC.INS-35%.RESISTANCE.	RESELC
RH1ERS205	RES.HEAT.R1: .05.ELC.INS-47%.RESISTANCE.	RESELC
RH1ERS305	RES.HEAT.R1: .05.ELC.INS-50%.RESISTANCE.	RESELC
RH1GEO005	RES.HEAT.R1: .05.GEO.INS-REG.EXCHANGER.	RESGEO
RH1HET005	RES.HEAT.R1: .05.HET.INS-REG.EXCHANGER.	RESHET
RH1HET105	RES.HEAT.R1: .05.HET.INS-35%.EXCHANGER.	RESHET
RH1HET205	RES.HEAT.R1: .05.HET.INS-47%.EXCHANGER.	RESHET
RH1HET305	RES.HEAT.R1: .05.HET.INS-50%.EXCHANGER.	RESHET

Technology	Description	Commodity IN
RH1HFO005	RES.HEAT.R1: .05.HFO.INS-REG.BURNER.	RESHFO
RH1KER005	RES.HEAT.R1: .05.KER.INS-REG.BURNER.	RESKER
RH1KER105	RES.HEAT.R1: .05.KER.INS-35%.BURNER.	RESKER
RH1KER205	RES.HEAT.R1: .05.KER.INS-47%.BURNER.	RESKER
RH1KER305	RES.HEAT.R1: .05.KER.INS-50%.BURNER.	RESKER
RH1LPG005	RES.HEAT.R1: .05.LPG.INS-REG.BURNER.	RESLPG
RH1LPG105	RES.HEAT.R1: .05.LPG.INS-35%.BURNER.	RESLPG
RH1LPG205	RES.HEAT.R1: .05.LPG.INS-47%.BURNER.	RESLPG
RH1LPG305	RES.HEAT.R1: .05.LPG.INS-50%.BURNER.	RESLPG
RH1NGA005	RES.HEAT.R1: .05.NGA.INS-REG.BURNER.STD.	RESNGA
RH1NGA105	RES.HEAT.R1: .05.NGA.INS-35%.BURNER.STD.	RESNGA
RH1NGA205	RES.HEAT.R1: .05.NGA.INS-47%.BURNER.STD.	RESNGA
RH1NGA305	RES.HEAT.R1: .05.NGA.INS-50%.BURNER.STD.	RESNGA
RH1NGC005	RES.HEAT.R1: .05.NGA.INS-REG.HEAT PUMP.AIR.HICOOL.	RESNGA
RH1NGC105	RES.HEAT.R1: .05.NGA.INS-35%.HEAT PUMP.AIR.HICOOL.	RESNGA
RH1NGC205	RES.HEAT.R1: .05.NGA.INS-47%.HEAT PUMP.AIR.HICOOL.	RESNGA
RH1NGC305	RES.HEAT.R1: .05.NGA.INS-50%.HEAT PUMP.AIR.HICOOL.	RESNGA
RH1NGD005	RES.HEAT.R1: .05.NGA.INS-REG.BURNER.IMP.	RESNGA
RH1NGD105	RES.HEAT.R1: .05.NGA.INS-35%.BURNER.IMP.	RESNGA
RH1NGD205	RES.HEAT.R1: .05.NGA.INS-47%.BURNER.IMP.	RESNGA
RH1NGD305	RES.HEAT.R1: .05.NGA.INS-50%.BURNER.IMP.	RESNGA
RH1NGE005	RES.HEAT.R1: .05.NGA.INS-REG.BURNER.NEW.	RESNGA
RH1NGE105	RES.HEAT.R1: .05.NGA.INS-35%.BURNER.NEW.	RESNGA
RH1NGE205	RES.HEAT.R1: .05.NGA.INS-47%.BURNER.NEW.	RESNGA
RH1NGE305	RES.HEAT.R1: .05.NGA.INS-50%.BURNER.NEW.	RESNGA
RH1NGS005	RES.HEAT.R1: .05.NGA.INS-REG.SOLAR	RESNGA
RH1NGS105	RES.HEAT.R1: .05.NGA.INS-35%.SOLAR.	RESNGA
RH1NGS205	RES.HEAT.R1: .05.NGA.INS-47%.SOLAR.	RESNGA
RH1NGS305	RES.HEAT.R1: .05.NGA.INS-50%.SOLAR.	RESNGA
RH1NHP005	RES.HEAT.R1: .05.NGA.INS-REG.HEAT PUMP.AIR.STD.	RESNGA
RH1NHP105	RES.HEAT.R1: .05.NGA.INS-35%.HEAT PUMP.AIR.STD.	RESNGA
RH1NHP205	RES.HEAT.R1: .05.NGA.INS-47%.HEAT PUMP.AIR.STD.	RESNGA
RH1NHP305	RES.HEAT.R1: .05.NGA.INS-50%.HEAT PUMP.AIR.STD.	RESNGA
RC1, RC2, RC3, RC4: Space cooling		
RC1EHP205	RES.COOL.R1: .05.ELC.INS-47%.HEAT PUMP.AIR.STD.	RESELC
RC1EHP305	RES.COOL.R1: .05.ELC.INS-50%.HEAT PUMP.AIR.STD.	RESELC
RC1ELA005	RES.COOL.R1: .05.ELC.INS-REG.HEAT PUMP.AIR.STD.	RESELC
RC1ELA105	RES.COOL.R1: .05.ELC.INS-35%.HEAT PUMP.AIR.STD.	RESELC
RC1ELB005	RES.COOL.R1: .05.ELC.INS-REG.HEAT PUMP.AIR.IMP.	RESELC
RC1ELB105	RES.COOL.R1: .05.ELC.INS-35%.HEAT PUMP.AIR.IMP.	RESELC
RC1ELB205	RES.COOL.R1: .05.ELC.INS-47%.HEAT PUMP.AIR.IMP.	RESELC
RC1ELB305	RES.COOL.R1: .05.ELC.INS-50%.HEAT PUMP.AIR.IMP.	RESELC
RC1ELC005	RES.COOL.R1: .05.ELC.INS-REG.CENTRAL.STD.	RESELC
RC1ELC105	RES.COOL.R1: .05.ELC.INS-35%.CENTRAL.STD.	RESELC
RC1ELC205	RES.COOL.R1: .05.ELC.INS-47%.CENTRAL.STD.	RESELC
RC1ELC305	RES.COOL.R1: .05.ELC.INS-50%.CENTRAL.STD.	RESELC
RC1ELD005	RES.COOL.R1: .05.ELC.INS-REG.ROOM.STD.	RESELC
RC1ELD105	RES.COOL.R1: .05.ELC.INS-35%.ROOM.STD.	RESELC
RC1ELD205	RES.COOL.R1: .05.ELC.INS-47%.ROOM.STD.	RESELC
RC1ELD305	RES.COOL.R1: .05.ELC.INS-50%.ROOM.STD.	RESELC
RC1ELE005	RES.COOL.R1: .05.ELC.INS-REG.HEAT PUMP.AIR.ADV.	RESELC
RC1ELE105	RES.COOL.R1: .05.ELC.INS-35%.HEAT PUMP.AIR.ADV.	RESELC
RC1ELE205	RES.COOL.R1: .05.ELC.INS-47%.HEAT PUMP.AIR.ADV.	RESELC
RC1ELE305	RES.COOL.R1: .05.ELC.INS-50%.HEAT PUMP.AIR.ADV.	RESELC
RC1ELF005	RES.COOL.R1: .05.GEO.INS-REG.HEAT PUMP.GROUND.STD.	RESGEO
RC1ELF105	RES.COOL.R1: .05.GEO.INS-35%.HEAT PUMP.GROUND.STD.	RESGEO
RC1ELF205	RES.COOL.R1: .05.GEO.INS-47%.HEAT PUMP.GROUND.STD.	RESGEO
RC1ELF305	RES.COOL.R1: .05.GEO.INS-50%.HEAT PUMP.GROUND.STD.	RESGEO
RC1ELG005	RES.COOL.R1: .05.ELC.INS-REG.ROOM.NEW.	RESELC
RC1ELG105	RES.COOL.R1: .05.ELC.INS-35%.ROOM.NEW.	RESELC
RC1ELG205	RES.COOL.R1: .05.ELC.INS-47%.ROOM.NEW.	RESELC
RC1ELG305	RES.COOL.R1: .05.ELC.INS-50%.ROOM.NEW.	RESELC
RC1GEO005	RES.COOL.R1: .05.GEO.INS-REG.HEAT PUMP.IMP.	RESGEO
RC1NGA005	RES.COOL.R1: .05.NGA.INS-REG.HEAT PUMP.AIR.STD.	RESNGA
RC1NGA105	RES.COOL.R1: .05.NGA.INS-35%.HEAT PUMP.AIR.STD.	RESNGA
RC1NGA205	RES.COOL.R1: .05.NGA.INS-47%.HEAT PUMP.AIR.STD.	RESNGA
RC1NGA305	RES.COOL.R1: .05.NGA.INS-50%.HEAT PUMP.AIR.STD.	RESNGA
RC1NGB005	RES.COOL.R1: .05.NGA.INS-REG.CENTRAL.NEW.	RESNGA
RC1NGB105	RES.COOL.R1: .05.NGA.INS-35%.CENTRAL.NEW.	RESNGA

Technology	Description	Commodity IN
RC1NGB205	RES.COOL.R1: .05.NGA.INS-47%.CENTRAL.NEW.	RESNGA
RC1NGB305	RES.COOL.R1: .05.NGA.INS-50%.CENTRAL.NEW.	RESNGA
RC1NGC005	RES.COOL.R1: .05.NGA.INS-REG.HEAT PUMP.AIR.HICOOL.	RESNGA
RC1NGC115	RES.COOL.R1: .05.NGA.INS-35%.HEAT PUMP.AIR.HICOOL.	RESNGA
RC1NGC225	RES.COOL.R1: .05.NGA.INS-47%.HEAT PUMP.AIR.HICOOL.	RESNGA
RC1NGC315	RES.COOL.R1: .05.NGA.INS-50%.HEAT PUMP.AIR.HICOOL.	RESNGA
RHW: Hot water heating		
RHWBIO005	RES: .05.BIO.WATER HEATER.STD.	RESBIO
RHWCOA005	RES: .05.COA.WATER HEATER.STD.	RESCOA
RHWDSO005	RES: .05.DST.WATER HEATER.SOLAR.	RESDST
RHWDST005	RES: .05.DST.WATER HEATER.STD.	RESDST
RHWELA005	RES: .05.ELC.WATER HEATER.HEAT PUMP.	RESELC
RHWELB005	RES: .05.ELC.WATER HEATER.RESISTANCE.NEW.	RESELC
RHWELC005	RES: .05.ELC.WATER HEATER.RESISTANCE.STD.	RESELC
RHWELS005	RES: .05.ELC.WATER HEATER.SOLAR.	RESELC
RHWKER005	RES: .05.KER.WATER HEATER.STD.	RESKER
RHWLPG005	RES: .05.LPG.WATER HEATER.STD.	RESLPG
RHWLPS005	RES: .05.LPG.WATER HEATER.SOLAR.	RESLPG
RHWNGA005	RES: .05.NGA.WATER HEATER.STD.	RESNGA
RHWNGA010	RES: .10.NGA.WATER HEATER.ADV.	RESNGA
RHWNGB005	RES: .05.NGA.WATER HEATER.NEW.	RESNGA
RHWNGS005	RES: .05.NGA.WATER HEATER.SOLAR.	RESNGA
RHWSOL005	RES: .05.SOL.WATER HEATER.STD.	RESSOL
RL1, RL2, RL3, RL4: Lighting		
RL1CFL005	RES.LIGH.R1: .05.ELC.FLUO.LAMP.COMPACT.	RESELC
RL1FLA005	RES.LIGH.R1: .05.ELC.FLUORESCENT.RAPIDSTART.	RESELC
RL1FLE005	RES.LIGH.R1: .05.ELC.FLUORESCENT.BASELINE.	RESELC
RL1HAE005	RES.LIGH.R1: .05.ELC.HALOGEN.	RESELC
RL1ICE005	RES.LIGH.R1: .05.ELC.INCANDESCENT.STD.	RESELC
RL1ICE010	RES.LIGH.R1: .10.ELC.INCANDESCENT.ADV.	RESELC
RL1KER005	RES.LIGH.R1: .05.KER.LAMP.	RESKER
RK1, RK2, RK3, RK4: Cooking		
RK1BIO005	RES.COOK.R1: .05.BIO.	RESBIO
RK1COA005	RES.COOK.R1: .05.COA.	RESCOA
RK1ELC005	RES.COOK.R1: .05.ELC.	RESELC
RK1KER005	RES.COOK.R1: .05.KER.	RESKER
RK1LPG005	RES.COOK.R1: .05.LPG.	RESLPG
RK1NGA005	RES.COOK.R1: .05.NGA.	RESNGA
RK1SOL005	RES.COOK.R1: .05.SOL.	RESSOL
RRF: Refrigerators and freezers		
RRFEXS005	RES: .05.ELC.REFRIGERATORS.STD.	RESELC
RRFGLD005	RES: .05.ELC.REFRIGERATORS.GOLDEN CARROT.	RESELC
RRFIMP005	RES: .05.ELC.REFRIGERATORS.IMP.	RESELC
RCW: Cloth washers		
RCWELC005	RES: .05.ELC.CLOTH WASHING.STD.	RESELC
RCWELC105	RES: .05.ELC.CLOTH WASHING.MID TEMP.	RESELC
RCWELC205	RES: .05.ELC.CLOTH WASHING.LOW TEMP.	RESELC
RCWELC305	RES: .05.ELC.CLOTH WASHING.REDUCED WATER.	RESELC
RCWELC405	RES: .05.ELC.CLOTH WASHING.ULTRA SOUND.	RESELC
RCWMIX005	RES: .05.MIX.CLOTH WASHING.STD.	RESELC
RCWMIX105	RES: .05.MIX.CLOTH WASHING.MID TEMP.	RESELC
RCWMIX205	RES: .05.MIX.CLOTH WASHING.LOW TEMP.	RESELC
RCWMIX305	RES: .05.MIX.CLOTH WASHING.REDUCED WATER.	RESELC
RCD: Cloth dryers		
RCDELC005	RES: .05.ELC.CLOTH DRIERS.STD.	RESELC
RCDELD010	RES: .10.ELC.CLOTH DRIERS.IMP.	RESELC
RCDNGA005	RES: .05.NGA.CLOTH DRIERS.STD.	RESNGA
RDW Dish washers		
RDWELC005	RES: .05.ELC.DISH WASHER.STD.	RESELC
RDWELC105	RES: .05.ELC.DISH WASHER.IMP.	RESELC
RDWELC210	RES: .10.ELC.DISH WASHER.ADV.	RESELC
RDWELM005	RES: .05.ELC.DISH WASHER.STD.	RESELC
RDWELM105	RES: .05.ELC.DISH WASHER.IMP.	RESELC
RDWELM210	RES: .10.ELC.DISH WASHER.ADV.	RESELC
REA: Miscellaneous electric energy		
REAELC005	RES: .05.ELC.EQUIPMENT.MISCELLANEOUS.	RESELC
ROT: Other energy uses		
ROTBIO005	RES: .05.BIO.EQUIPMENT.OTHERS.	RESBIO

Technology	Description	Commodity IN
ROTCOA005	RES: .05.COA.EQUIPMENT.OTHERS.	RESCOA
ROTDST005	RES: .05.DST.EQUIPMENT.OTHERS.	RESDST
ROTGEO005	RES: .05.GEO.EQUIPMENT.OTHERS.	RESGEO
ROTHET005	RES: .05.HET.EQUIPMENT.OTHERS.	RESHET
ROTHFO005	RES: .05.HFO.EQUIPMENT.OTHERS.	RESHFO
ROTKER005	RES: .05.KER.EQUIPMENT.OTHERS.	RESKER
ROTLPG005	RES: .05.LPG.EQUIPMENT.OTHERS.	RESLPG
ROTNGA005	RES: .05.NGA.EQUIPMENT.OTHERS.	RESNGA
ROTSOL005	RES: .05.SOL.EQUIPMENT.OTHERS.	RESSOL
CH1, CH2. CH3, CH4: Space heating		
CH1BIO005	COM.HEAT.R1: .05.BIO.BURNER.	COMBIO
CH1COA005	COM.HEAT.R1: .05.COA.BURNER.	COMCOA
CH1DSA005	COM.HEAT.R1: .05.DST.BURNER.NEW.	COMDST
CH1DSD005	COM.HEAT.R1: .05.DST.BURNER.IMP.	COMDST
CH1DSO005	COM.HEAT.R1: .05.DST.SOLAR.	COMDST
CH1DST005	COM.HEAT.R1: .05.DST.BURNER.STD.	COMDST
CH1DST010	COM.HEAT.R1: .10.DST.BURNER.ADV.	COMDST
CH1EHP005	COM.HEAT.R1: .05.ELC.HEAT PUMP.AIR.STD.	COMELC
CH1ELB005	COM.HEAT.R1: .05.ELC.HEAT PUMP.AIR.IMP.	COMELC
CH1ELD005	COM.HEAT.R1: .05.GEO.HEAT PUMP.GROUND.IMP.	COMGEO
CH1ELD010	COM.HEAT.R1: .10.GEO.HEAT PUMP.GROUND.ADV.	COMGEO
CH1ERS005	COM.HEAT.R1: .05.ELC.RESISTANCE.	COMELC
CH1GEO005	COM.HEAT.R1: .05.GEO.EXCHANGER.	COMGEO
CH1HET005	COM.HEAT.R1: .05.HET.EXCHANGER.	COMHET
CH1HFA005	COM.HEAT.R1: .05.HFO.BURNER.ADV.	COMHFO
CH1HFB005	COM.HEAT.R1: .05.HFO.BURNER.IMP.	COMHFO
CH1HFO005	COM.HEAT.R1: .05.HFO.BOILER.STD.	COMHFO
CH1KER005	COM.HEAT.R1: .05.KER.	COMKER
CH1LPG005	COM.HEAT.R1: .05.LPG.	COMLPG
CH1NGA005	COM.HEAT.R1: .05.NGA.BURNER.STD.	COMNGA
CH1NGB005	COM.HEAT.R1: .05.NGA.BURNER.IMP.	COMNGA
CH1NGC005	COM.HEAT.R1: .05.NGA.BURNER.ADV.	COMNGA
CH1NHP005	COM.HEAT.R1: .05.NGA.HEAT PUMP.STD.	COMNGA
CC1, CC2. CC3. CC4: Space cooling		
CC1DST005	COM.COOL.R1: .05.DST.CHILLER.	COMDST
CC1DST015	COM.COOL.R1: .15.DST.CHILLER.	COMDST
CC1ELA005	COM.COOL.R1: .05.ELC.HEAT PUMP.AIR.STD.	COMELC
CC1ELB005	COM.COOL.R1: .05.ELC.HEAT PUMP.AIR.IMP.	COMELC
CC1ELC005	COM.COOL.R1: .05.ELC.CHILLER.ROOFTOP.STD.	COMELC
CC1ELD005	COM.COOL.R1: .05.GEO.HEAT PUMP.GROUND.IMP.	COMGEO
CC1ELD010	COM.COOL.R1: .10.GEO.HEAT PUMP.GROUND.ADV.	COMGEO
CC1ELF005	COM.COOL.R1: .05.ELC.CHILLER.ROOFTOP.NEW.	COMELC
CC1ELG005	COM.COOL.R1: .05.ELC.CHILLER.RECIPROCATING.NEW.	COMELC
CC1ELG010	COM.COOL.R1: .10.ELC.CHILLER.RECIPROCATING.IMP.	COMELC
CC1ELI005	COM.COOL.R1: .05.ELC.CHILLER.CENTRIFUGAL.NEW.	COMELC
CC1ELI015	COM.COOL.R1: .15.ELC.CHILLER.CENTRIFUGAL.IMP.	COMELC
CC1ELK005	COM.COOL.R1: .05.ELC.CENTRAL.	COMELC
CC1ELR005	COM.COOL.R1: .05.ELC.ROOM.	COMELC
CC1GEO005	COM.COOL.R1: .05.GEO.HEAT PUMP.IMP.	COMGEO
CC1NGA005	COM.COOL.R1: .05.NGA.CHILLER.ABSORPTION.	COMNGA
CC1NGB005	COM.COOL.R1: .05.NGA.CHILLER.ENGINE.STD.	COMNGA
CC1NGB010	COM.COOL.R1: .10.NGA.CHILLER.ENGINE.IMP.	COMNGA
CHW: Hot water heating		
CHWCOA005	COM: .05.COA.WATER HEATER.STD.	COMCOA
CHWDSA005	COM: .05.DST.WATER HEATER.IMP.	COMDST
CHWDST005	COM: .05.DST.WATER HEATER.STD.	COMDST
CHWELA005	COM: .05.ELC.WATER HEATER.HEAT PUMP.STD.	COMELC
CHWELB005	COM: .05.ELC.WATER HEATER.HEAT PUMP.ADV.	COMELC
CHWELC005	COM: .05.ELC.WATER HEATER.RESISTANCE.IMP.	COMELC
CHWELD005	COM: .05.ELC.WATER HEATER.RESISTANCE.STD.	COMELC
CHWHFO005	COM: .05.HFO.WATER HEATER.STD.	COMHFO
CHWKER005	COM: .05.KER.WATER HEATER.STD.	COMKER
CHWLPG005	COM: .05.LPG.WATER HEATER.STD.	COMLPG
CHWNGA005	COM: .05.NGA.WATER HEATER.STD.	COMNGA
CHWNGB005	COM: .05.NGA.WATER HEATER.IMP.	COMNGA
CHWSOD005	COM: .05.SOL.WATER HEATER.DST.	COMSOL
CHWSOL005	COM: .05.SOL.WATER HEATER.STD.	COMSOL

Technology	Description	Commodity IN
CLA: Lighting		
CLACFL005	COM.LIGH: .05.ELC.FLUO.LAMP.COMPACT.	COMELC
CLAFLA005	COM.LIGH: .05.ELC.FLUORESCENT.RAPIDSTART.	COMELC
CLAFLB005	COM.LIGH: .05.ELC.FLUORESCENT.ELECTRODELESS.	COMELC
CLAFLE005	COM.LIGH: .05.ELC.FLUORESCENT.BASELINE.	COMELC
CLAHAE005	COM.LIGH: .05.ELC.HALOGEN.	COMELC
CLAHID005	COM.LIGH: .05.ELC.MERCURY.	COMELC
CLAICE005	COM.LIGH: .05.ELC.INCANDESCENT.	COMELC
CLAKER005	COM.LIGH: .05.KER.LAMP.	COMKER
CLASUL005	COM.LIGH: .05.ELC.SULFER.	COMELC
CCK: Cooking		
CCKBIO005	COM: .05.BIO.COOKING.	COMBIO
CCKCOA005	COM: .05.COA.COOKING.	COMCOA
CCKELC005	COM: .05.ELC.COOKING.	COMELC
CCKKER005	COM: .05.KER.COOKING.	COMKER
CCKLPG005	COM: .05.LPG.COOKING.	COMLPG
CCKNGA005	COM: .05.NGA.COOKING.	COMNGA
CRF: Refrigerators and freezers		
CRFELC005	COM: .05.ELC.REFRIGERATORS.	COMELC
COE: Electric equipments		
COEELC005	COM: .05.ELC.EQUIPMENT.MISCELLANEOUS.	COMELC
COT: Other energy uses		
COTDST005	COM: .05.DST.EQUIPMENT.OTHERS.	COMDST
COTELC005	COM: .05.ELC.EQUIPMENT.OTHERS.	COMELC
COTNGA005	COM: .05.NGA.EQUIPMENT.OTHERS.	COMNGA

4.4.3 Technology naming conventions

The existing and the new technologies are always identified with a nine-character code (e.g. RESELC000, COMDST010):

- The first three letters refer to the sector, which are RES for residential and COM for commercial.
- The next three letters are related to the fuel consumed by the technology, such as ELC for electricity and DST for diesel. Because there are many technologies, some variants are used to avoid repeated codes, for instance anything beginning with E* for electricity and D* for diesel.
- The last three digits refer to the year of the technology's availability, such as 000 for 2000 and 020 for 2020. The new insulation technologies, not currently considered in SAGE, are identified by numbers such as 105, 205 and 305 for the different insulation levels (respectively 35%, 47% and 50%).

The description of the existing technologies (e.g. RES.HEAT.R1: .00.NGA.INS-REG.BURNER.STD.) contains:

- The sector, the end-use and the sub-region for heating, cooling, lighting and cooking end-uses, such as (RES.HEAT.R1:), or only the sector (RES:).
- The year of availability, that is always (.00.) for 2000.
- The fuel consumption, such as (.NGA.) for natural gas.
- The insulation information for heating and cooling, which is always (.INS-REG.) for standard insulation.
- The technology description, such as (.BURNER. or .HEAT PUMP.) for heating and (.CLOTH DRIERS. or .WATER HEATER.) for appliances.
- The efficiency, which is mainly standard (.STD.) but sometimes improved (.IMP.).

The new technologies have been described in a uniform way to facilitate the creation of user-defined constraints (e.g. COM.HEAT.R1: .10.DST.BURNER.ADV.). The description contains:

- The sector, the end-use and the sub-region (for heating, cooling, lighting and cooking), such as (COM.HEAT.R1:), or only the sector (COM:).
- The year of availability, such as (.10.) for 2010.
- The fuel consumption, such as (.DST.) for diesel.
- The insulation information for space heating and cooling technologies, such as (.INS-35%.) for a 35% insulation. Sage currently assumes standard levels of insulation.
- The technology description, such as (.INCANDESCENT. or .FLUORESCENT.) for lighting, and (.CLOTH DRIERS. or .WATER HEATER.) for the appliances.
- The efficiency, which can be standard (.STD.), improved (.IMP.), advanced (.ADV.) or other specification, such as (.RAPIDSTART. and .BASELINE.) for the fluorescents.

Note that there are no new technologies associated with the generic demand (AGR: Agriculture). In this sector, it is assumed that increases in agricultural output result in proportionate increases in fuel input. In the industrial, as well as the agricultural sector, SAGE allows investment in existing generic technologies. It would be a simple matter to define new agriculture technologies every period using a changing mix of inputs.

4.5 User-defined technology market share parameters and constraints

Same methodology as described in section 3.5 of this volume.

Residential sector examples:

- The first level controls the relative consumption of each fuel, such as (*.NGA.*) or (*.ELC.*), for each end-use in each sub-region.
  - S_RC1_ELC: Min Share of All electric cooling technologies in Region 1
- The second level controls the penetration of different technologies for each fuel/end-use in each region, such as (*.HEAT PUMP.*) or (*.CHILLER.*) for electric space cooling.
  - S_ RC1_EHP: Min Share of electric heat pump cooling in Region 1
- The third level controls the penetration of technologies with different efficiencies or characteristics, such as (*.STD.*) and (*.IMP.*) for electric heat pump, or such as (*.RECIPROCATING.*) and (*.CENTRIFUGAL.*) for electric chillers for space cooling.
  - S_RC1_EHS: Min Share of standard electric heat pump cooling in Region 1

Note that all end-uses do not necessarily have the three levels of ser-defined constraints. See Table A 4 in appendix for the complete list of minimum User-defined constraints in the residential and the commercial sectors and their descriptions.

There are also two additional sets of maximum User-defined constraints used in SAGE (Table A 5).

- The first set is to limit the penetration of total biomass (.BIO.), heat (.HET.) and geothermal (.GEO.) in residential and commercial space heating.
  - S_RH1_BIU: Max Share of All biomass heating technologies in Region 1
- The second set is to limit the penetration of total biomass (.BIO.) and solar (.SOL.) in residential and commercial water heating and residential cooking.
  - S_CHW_SOU: Max Share of All solar water heating technologies in commercial

5. Industries

5.1 Demand segments

The industrial sector is characterized by six energy service services, each representing either the physical output of the industry or the total energy requirement, plus one 'other industries' demand segment, which is considered as a generic demand, and one 'very other industries' segment (Table 16). This last one has been added for very minor calibration purposes and is generally not used.

Table 16. Industrial segments

Industrial segments (6)	Codes
Iron and steel	IIS
Non ferrous metals	INF
Chemicals	ICH
Pulp and paper	ILP
Non metal minerals	INM
Other industries	IOI
Other segment (2)	**Codes**
Other non specified energy consumption	ONO
Very other industries	I00

The industry categories are based on the IEA database. They refer to the international ISIC (International Standard Industrial Classification) classification of economic activities.[1]

- Iron and steel industry [ISIC Group 271 and Class 2731];
- Chemical industry [ISIC Division 24];
- Non-ferrous metals basic industries [ISIC Group 272 and Class 2732];
- Non-metallic mineral products [ISIC Division 26];
- Paper, pulp and print [ISIC Divisions 21 and 22];
- Others:
    - Transport equipment [ISIC Divisions 34 and 35];
    - Machinery [ISIC Divisions 28, 29, 30, 31 and 32];
    - Mining (excluding fuels) and quarrying [ISIC Divisions 13 and 14];
    - Food and tobacco [ISIC Divisions 15 and 16];
    - Wood and wood products (other than pulp and paper) [ISIC Division 20];
    - Construction [ISIC Division 45];
    - Textile and leather [ISIC Divisions 17, 18 and 19];
- Non-specified [ISIC Divisions 25, 33, 36 and 37].

These energy services are identified by a four-letter code beginning with I, followed by one letter designating the service (S for Boiler or Steam, P for Process Heat, M for Machine Drive, E for Electro-Chemical Process, O for Others, N for Non-Energy), and ending with the two letters of the industry (Table 17). Hence, the energy services are identified with a letter inserted after the first I for Industry:. Note that feedstocks are included in chemicals (IFCH) and iron and steel (IFIS) and non-energy uses are included in other industries (INOI).

[1] See http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=17&Lg=1

As the IEA database only provides total energy consumption by fuel for the main industries, fractional share numbers were needed to split fuel consumption between specific energy services within each industry (Table 18). According to the regions, the need for expert assumptions depended on the level of detail of the national data sources. The non-specified energy consumption (ONO) is also provided by the IEA database. As for the very other industries (I00), this segment has been used in last resort for calibration purposes to create a demand for coal, gas, oil or electricity. See Table B 1 to Table B 77, in Appendix B of this volume, for the share of industrial energy services by fuel in each of the 15 regions.

Table 17. The energy services in each industry

Industrial segments (6)	Codes	Boilers	Process Heat	Machine Drive	Electro-chemical	Others	Feed-stocks	Non-energy
Iron and steel	IIS	ISIS	IPIS	IMIS	IEIS	IOIS	IFIS	
Non ferrous metals	INF	ISNF	IPNF	IMNF	IENF	IONF		
Chemicals	ICH	ISCH	IPCH	IMCH	IECH	IOCH	IFCH	
Pulp and paper	ILP	ISLP	IPLP	IMLP	IELP	IOLP		
Non metal minerals	INM	ISNM	IPNM	IMNM	IENM	IONM		
Other industries	IOI	ISOI	IPOI	IMOI	IEOI	IOOI		INOI

Table 18. Sample share of industrial energy services by fuel

Fuel	ISIS	ISIS	IPIS	IMIS	IEIS	IOIS	Total	ISNF	ISNF	IPNF	IMNF	IENF	IONF	Total
INDELC			0.43	0.43	0.03	0.11	1.00				0.03	0.95	0.03	1.00
INDNGA	0.13		0.76	0.00		0.10	1.00	0.10		0.85			0.05	1.00
INDLPG			1.00				1.00			1.00				1.00
INDNGL						1.00	1.00						1.00	1.00
INDCOA	0.05		0.95				1.00	0.05		0.95				1.00
INDCOK							1.00							1.00
INDCOG		1.00					1.00						1.00	1.00
INDBFG		0.38	0.60			0.02	1.00						1.00	1.00
INDOXY			1.00				1.00						1.00	1.00
INDHFO	0.04	0.79	0.15			0.02	1.00	0.69		0.29			0.02	1.00
INDOIL	0.17	0.54	0.17			0.12	1.00	0.17		0.17			0.67	1.00
INDETH						1.00	1.00						1.00	1.00
INDNAP						1.00	1.00						1.00	1.00
INDPTC						1.00	1.00						1.00	1.00
INDBIO						1.00	1.00						1.00	1.00
INDGEO						1.00	1.00						1.00	1.00
INDHET	1.00						1.00						1.00	1.00
INDELC			0.43	0.43	0.03	0.11	1.00				0.03	0.95	0.03	1.00

Table 18 (continued). Sample share of industrial energy services by fuel

Fuel	ISCH	ISCH	IPCH	IMCH	IECH	IFCH	IOCH	Total	ISLP	ISLP	IPLP	IMLP	IELP	IOLP	Total
INDELC	0.02		0.04	0.65	0.13		0.16	1.00			0.05	0.85		0.10	1.00
INDNGA	0.49	0.13	0.34	0.02			0.02	1.00	0.10	0.70	0.18	0.02		0.01	1.00
INDLPG						1.00		1.00						1.00	1.00
INDNGL							1.00	1.00						1.00	1.00
INDCOA	1.00							1.00	0.10	0.89				0.01	1.00
INDCOK							1.00	1.00						1.00	1.00
INDCOG							1.00	1.00						1.00	1.00
INDBFG							1.00	1.00						1.00	1.00
INDOXY							1.00	1.00						1.00	1.00
INDHFO		1.00					0.00	1.00		0.84	0.13			0.03	1.00
INDOIL		0.23					0.77	1.00	0.24	0.31				0.45	1.00
INDETH						1.00		1.00						1.00	1.00
INDNAP						1.00		1.00						1.00	1.00

Fuel	ISCH	ISCH	IPCH	IMCH	IECH	IFCH	IOCH	Total	ISLP	ISLP	IPLP	IMLP	IELP	IOLP	Total
INDPTC							1.00	1.00						1.00	1.00
INDBIO							1.00	1.00	0.22	0.73				0.05	1.00
INDGEO							1.00	1.00	1.00						1.00
INDHET			1.00					1.00	1.00						1.00
INDELC	0.02		0.04	0.65	0.13		0.16	1.00			0.05	0.85		0.10	1.00

Table 18 (continued). Sample share of industrial energy services by fuel

Fuel	ISNM	ISNM	IPNM	IMNM	IENM	IONM	Total	ISOI	ISOI	IPOI	IMOI	IEOI	IOOI	Total
INDELC	0.01		0.15	0.75		0.09	1.00	0.01		0.10	0.70	0.04	0.15	1.00
INDNGA	0.05		0.86	0.02		0.08	1.00		0.75	0.20	0.02		0.03	1.00
INDLPG			0.50			0.50	1.00	0.15		0.50	0.05		0.30	1.00
INDNGL						1.00	1.00						1.00	1.00
INDCOA		0.23	0.77			0.00	1.00	0.11	0.89				0.00	1.00
INDCOK			1.00				1.00						1.00	1.00
INDCOG			1.00				1.00						1.00	1.00
INDBFG			1.00				1.00						1.00	1.00
INDOXY			1.00				1.00						1.00	1.00
INDHFO			1.00				1.00		0.99				0.01	1.00
INDOIL	0.10		0.80			0.10	1.00	0.28	0.02	0.20	0.12		0.38	1.00
INDETH							1.00						1.00	1.00
INDNAP							1.00						1.00	1.00
INDPTC			1.00				1.00		1.00					1.00
INDBIO	1.00						1.00	1.00						1.00
INDGEO	1.00						1.00						1.00	1.00
INDHET			1.00				1.00	1.00						1.00
INDELC	0.01		0.15	0.75		0.09	1.00	0.01		0.10	0.70	0.04	0.15	1.00

5.2 Projections

Same methodology as described in section 3.2 for the transportation sector. See Table B 16 to Table B 32, in Appendix B of this volume.

5.3 Fuels

The IEA database lists industrial energy consumption for 31 different fuels, which are aggregated in 18 different categories consumed by the industries (Table 19). Aggregation ratios are based on data provided by the IEA database. The user may decide to change them for future years. Fuels are named uniformly across sectors.

Table 19. Technologies created to produce industry sector fuels

Technology	Description	Commodity IN [a]	Commodity OUT
INDNGA000	Fuel Tech - Natural Gas Mix (IND)	GASNGA GASGWG	INDNGA
INDNGA111	Fuel Tech - Natural Gas (IND)	GASNGA	INDNGA
INDLPG000	Fuel Tech - Liquified Petroleum Gases (IND)	GASLPG	INDLPG
INDNGL000	Fuel Tech - Natural Gas Liquids (IND)	OILNGL	INDNGL
INDCOA000	Fuel Tech - Coal (IND)	COAHCO COABCO	INDCOA
INDCOK000	Fuel Tech - Ovencoke (IND)	COAOVC	INDCOK
INDCOG000	Fuel Tech - Coke Oven Gas (IND)	GASCOG	INDCOG
INDBFG000	Fuel Tech - Blast Furnace Gas (IND)	GASBFG COAGSC	INDBFG
INDOXY000	Fuel Tech - Oxygen Steel Furnace Gas (IND)	GASOXY	INDOXY
INDHFO000	Fuel Tech - Heavy Fuel Oil (IND)	OILHFO OILCRD OILNSP	INDHFO
INDOIL000	Fuel Tech - Refined Petroleum Products (IND)	OILDST OILKER OILGSL OILJTK	INDOIL
INDCRD111	Fuel Tech - Heavy Crude Oil (IND)	OILCRD	INDCRD
INDETH000	Fuel Tech - Ethane (IND)	GASETH GASRFG	INDETH
INDNAP000	Fuel Tech - Naphta (IND)	OILNAP	INDNAP
INDPTC000	Fuel Tech - Petroleum Coke (IND)	OILPTC	INDPTC
INDBIO000	Fuel Tech - Biofuels (IND)	BIOBSL BIOCHR BIOGAS BIOBMU BIOBIN	INDBIO
INDGEO000	Fuel Tech - Geothermal (IND)	GEO	INDGEO
INDELC000	Fuel Tech - Electricity (IND)	ELC	INDELC
INDHET000	Fuel Tech - Heat (IND)	HET	INDHET

[a] See section 7 for description of these commodities.

The technologies created to produce aggregated industrial fuels (Fuel Tech) are named uniformly using the name of the aggregated fuels as specified in the column Commodity OUT plus three zero (000 for existing technology in 2000). Their description changes according to the fuel (e.g. Fuel Tech - Coal (IND) or Fuel Tech - Natural Gas (IND). The fractional shares of the disaggregated fuels (Commodity IN) used to produce an aggregated fuel (Commodity OUT) are calculated from their consumption over the total for this category, as given in the IEA database.

5.4 Technologies

5.4.1 Existing technologies

For each energy service of each industry, a number of existing technologies are in competition to satisfy energy service demand (Table 20). They are characterized by an efficiency, an annual utilization factor, a lifetime, operation costs, and six seasonal share coefficients (summer-day, summer-night, intermediary-day, intermediary-night, winter-day, winter-night). No new investment is allowed in the existing technologies in any sector.

Table 20. Existing technologies in the industrial sector

Technology	Description	Commodity IN	Commodity OUT
IIS: Iron and steel			
IIS000	Existing Iron and Steel Tech	ISIS	IIS
ISISHFO000	Steam Iron and Steel Heavy Oil Existing	INDHFO	ISIS
ISISDST000	Steam Iron and Steel Distillate Oil Existing	INDOIL	ISIS
ISISNGA000	Steam Iron and Steel Natural Gas Existing	INDNGA	ISIS
ISISCOA000	Steam Iron and Steel Coal Existing	INDCOA	ISIS
IPISHFO000	Process Heat Iron and Steel Heavy Fuel Existing	INDHFO	IPIS
IPISDST000	Process Heat Iron and Steel Distillate Fuel Existing	INDOIL	IPIS
IPISNGA000	Process Heat Iron and Steel Natural Gas Existing	INDNGA	IPIS
IPISCOA000	Process Heat Iron and Steel Coal Existing	INDCOA	IPIS
IPISELC000	Process Heat Iron and Steel Electric Existing	INDELC	IPIS
IPISCOG000	Process Heat Iron and Steel Cokeoven Gas Existing	INDCOG	IPIS
IPISBFG000	Process Heat Iron and Steel Blast Furnace Gas Existing	INDBFG	IPIS
IPISLPG000	Process Heat Iron and Steel LPG Existing	INDLPG	IPIS
IMISHFO000	Machine Drive Iron and Steel Heavy Oil Existing	INDHFO	IMIS
IMISDST000	Machine Drive Iron and Steel Distillate Oil Existing	INDOIL	IMIS
IMISNGA000	Machine Drive Iron and Steel Natural Gas Existing	INDNGA	IMIS
IMISCOA000	Machine Drive Iron and Steel Coal Existing	INDCOA	IMIS
IMISELC000	Machine Drive Iron and Steel Electric Existing	INDELC	IMIS
IMISLPG000	Machine Drive Iron and Steel LPG Existing	INDLPG	IMIS
IEISELC000	Electro-Chemical Process Iron and Steel Electric Existing	INDELC	IEIS
IOISHFO000	Other Iron and Steel Heavy Oil Existing	INDHFO	IOIS
IOISDST000	Other Iron and Steel Distillate Oil Existing	INDOIL	IOIS
IOISNGA000	Other Iron and Steel Natural Gas Existing	INDNGA	IOIS
IOISELC000	Other Iron and Steel Electric Existing	INDELC	IOIS
IOISBIO000	Other Iron and Steel BIO Existing	INDBIO	IOIS
IFISCOK000	Coke consumption in Iron and Steel Existing	COAOVC	IOIS
INF: Non ferrous metals			
INF000	Existing Non-Ferrous Tech	ISNF	INF
ISNFHFO000	Steam Non-ferrous metals Heavy Oil Existing	INDHFO	ISNF
ISNFDST000	Steam Non-ferrous metals Distillate Oil Existing	INDOIL	ISNF
ISNFNGA000	Steam Non-ferrous met Natural Gas Existing	INDNGA	ISNF
ISNFCOA000	Steam Non-ferrous metals Coal Existing	INDCOA	ISNF
IPNFHFO000	Process Heat N-ferrous met Heavy Fuel Existing	INDHFO	IPNF
IPNFDST000	Process Heat N-ferrous met Distillate Fuel Existing	INDOIL	IPNF
IPNFNGA000	Process Heat N-ferrous met Natural Gas Existing	INDNGA	IPNF
IPNFCOA000	Process Heat N-ferrous met Coal Existing	INDCOA	IPNF
IPNFELC000	Process Heat N-ferrous met Electric Existing	INDELC	IPNF
IPNFLPG000	Process Heat N-ferrous met LPG Existing	INDLPG	IPNF
IMNFHFO000	Machine Drive N-ferrous met Heavy Oil Existing	INDHFO	IMNF
IMNFDST000	Machine Drive N-ferrous met Distillate Oil Existing	INDOIL	IMNF
IMNFNGA000	Machine Drive N-ferrous met Natural Gas Existing	INDNGA	IMNF
IMNFCOA000	Machine Drive N-ferrous met Coal Existing	INDCOA	IMNF
IMNFELC000	Machine Drive N-ferrous met Electric Existing	INDELC	IMNF
IMNFLPG000	Machine Drive N-ferrous met LPG Existing	INDLPG	IMNF
IENFELC000	Electro-Chemical Process N-ferrous met Electric Existing	INDELC	IENF
IONFHFO000	Other N-ferrous met Heavy Oil Existing	INDHFO	IONF
IONFDST000	Other N-ferrous met Distillate Oil Existing	INDOIL	IONF
IONFNGA000	Other N-ferrous met Natural Gas Existing	INDNGA	IONF
IONFELC000	Other N-ferrous met Electric Existing	INDELC	IONF
IONFBIO000	Other N-ferrous met BIO Existing	INDBIO	IONF
ICH: Chemicals			
ICH000	Existing Chemicals Tech	ISCH	ICH
ISCHHFO000	Steam Chemicals Heavy Oil Existing	INDHFO	ISCH
ISCHDST000	Steam Chemicals Distillate Oil Existing	INDOIL	ISCH
ISCHNGA000	Steam Chemicals Natural Gas Existing	INDNGA	ISCH
ISCHCOA000	Steam Chemicals Coal Existing	INDCOA	ISCH
ISCHELC000	Steam Chemicals Electric Existing	INDELC	ISCH
IPCHHFO000	Process Heat Chemicals Heavy Fuel Existing	INDHFO	IPCH
IPCHDST000	Process Heat Chemicals Distillate Fuel Existing	INDOIL	IPCH
IPCHNGA000	Process Heat Chemicals Natural Gas Existing	INDNGA	IPCH
IPCHCOA000	Process Heat Chemicals Coal Existing	INDCOA	IPCH
IPCHELC000	Process Heat Chemicals Electric Existing	INDELC	IPCH
IPCHLPG000	Process Heat Chemicals LPG Existing	INDLPG	IPCH
IMCHHFO000	Machine Drive Chemicals Heavy Oil Existing	INDHFO	IMCH
IMCHDST000	Machine Drive Chemicals Distillate Oil Existing	INDOIL	IMCH
IMCHNGA000	Machine Drive Chemicals Natural Gas Existing	INDNGA	IMCH

Technology	Description	Commodity IN	Commodity OUT
IMCHCOA000	Machine Drive Chemicals Coal Existing	INDCOA	IMCH
IMCHELC000	Machine Drive Chemicals Electric Existing	INDELC	IMCH
IMCHLPG000	Machine Drive Chemicals LPG Existing	INDLPG	IMCH
IECHELC000	Electro-Chemical Process Chemicals Electric Existing	INDELC	IECH
IOCHHFO000	Other Chemicals Heavy Oil Existing	INDHFO	IOCH
IOCHDST000	Other Chemicals Distillate Oil Existing	INDOIL	IOCH
IOCHNGA000	Other Chemicals Natural Gas Existing	INDNGA	IOCH
IOCHELC000	Other Chemicals Electric Existing	INDELC	IOCH
IOCHLPG000	Other Chemicals LPG Existing	INDLPG	IOCH
IOCHBIO000	Other Chemicals BIO Existing	INDBIO	IOCH
IFCHNGA000	Technology to convert Natural Gas to non-energy petrochemical feedstocks	GASNGA	IFCH
IFCHLPG000	Technology to convert LPG to non-energy petrochemical feedstocks	GASLPG	IFCH
IFCHNGL000	Technology to convert NGL to non-energy petrochemical feedstocks	OILNGL	IFCH
IFCHCOA000	Technology to convert Coal to non-energy petrochemical feedstocks	COAHCO	IFCH
IFCHCOK000	Technology to convert Coke to non-energy petrochemical feedstocks	COAOVC	IFCH
IFCHHFO000	Technology to convert Heavy Fuel Oil to non-energy petrochemical feedstocks	OILHFO	IFCH
IFCHDST000	Technology to convert Distillate to non-energy petrochemical feedstocks	OILDST	IFCH
IFCHETH000	Technology to convert Ethane to non-energy petrochemical feedstocks	GASETH	IFCH
IFCHBLQ000	Technology to convert Biofuels to non-energy petrochemical feedstocks	BIOGAS	IFCH
IFCHNAP000	Technology to convert Naphtha to non-energy petrochemical feedstocks	OILNAP	IFCH
ILP: Pulp and paper			
ILP000	Existing Pulp and Paper Tech	ISLP	ILP
ISLPHFO000	Steam Pulp and Paper Heavy Oil Existing	INDHFO	ISLP
ISLPDST000	Steam Pulp and Paper Distillate Oil Existing	INDOIL	ISLP
ISLPNGA000	Steam Pulp and Paper Natural Gas Existing	INDNGA	ISLP
ISLPCOA000	Steam Pulp and Paper Coal Existing	INDCOA	ISLP
ISLPELC000	Steam Pulp and Paper Electric Existing	INDELC	ISLP
ISLPBIO000	Steam Pulp and Paper Electric Existing	INDBIO	ISLP
ISLPHET000	Steam Pulp and Paper Electric Existing	INDHET	ISLP
IPLPHFO000	Process Heat Pulp and Paper Heavy Fuel Existing	INDHFO	IPLP
IPLPDST000	Process Heat Pulp and Paper Distillate Fuel Existing	INDOIL	IPLP
IPLPNGA000	Process Heat Pulp and Paper Natural Gas Existing	INDNGA	IPLP
IPLPCOA000	Process Heat Pulp and Paper Coal Existing	INDCOA	IPLP
IPLPELC000	Process Heat Pulp and Paper Electric Existing	INDELC	IPLP
IPLPLPG000	Process Heat Pulp and Paper LPG Existing	INDLPG	IPLP
IMLPHFO000	Machine Drive Pulp and Paper Heavy Oil Existing	INDHFO	IMLP
IMLPDST000	Machine Drive Pulp and Paper Distillate Oil Existing	INDOIL	IMLP
IMLPNGA000	Machine Drive Pulp and Paper Natural Gas Existing	INDNGA	IMLP
IMLPCOA000	Machine Drive Pulp and Paper Coal Existing	INDCOA	IMLP
IMLPELC000	Machine Drive Pulp and Paper Electric Existing	INDELC	IMLP
IMLPLPG000	Machine Drive Pulp and Paper LPG Existing	INDLPG	IMLP
IELPELC000	Electro-Chemical Process Pulp and Paper Electric Existing	INDELC	IELP
IOLPHFO000	Other Pulp and Paper Heavy Oil Existing	INDHFO	IOLP
IOLPDST000	Other Pulp and Paper Distillate Oil Existing	INDOIL	IOLP
IOLPNGA000	Other Pulp and Paper Natural Gas Existing	INDNGA	IOLP
IOLPELC000	Other Pulp and Paper Electric Existing	INDELC	IOLP
IOLPLPG000	Other Pulp and Paper LPG Existing	INDLPG	IOLP
IOLPNGL000	Other Pulp and Paper NGL Existing	INDNGL	IOLP
IOLPCOA000	Other Pulp and Paper Coal Existing	INDCOA	IOLP
IOLPCOK000	Other Pulp and Paper Coke Existing	INDCOK	IOLP
IOLPCOG000	Other Pulp and Paper Cokeoven Gas Existing	INDCOG	IOLP
IOLPNAP000	Other Pulp and Paper Naphtha Existing	INDNAP	IOLP
IOLPPTC000	Other Pulp and Paper Petroleum Coke Existing	INDPTC	IOLP
INM: Non metal minerals			
INM000	Existing Non metallic minerals	ISNM	INM
ISNMHFO000	Steam Non-metals Heavy Oil Existing	INDHFO	ISNM
ISNMDST000	Steam Non-metals Distillate Oil Existing	INDOIL	ISNM
ISNMNGA000	Steam Non-metals Natural Gas Existing	INDNGA	ISNM

Technology	Description	Commodity IN	Commodity OUT
ISNMCOA000	Steam Non-metals Coal Existing	INDCOA	ISNM
ISNMELC000	Steam Non-metals Electric Existing	INDELC	ISNM
IPNMHFO000	Process Heat Non-metals Heavy Fuel Existing	INDHFO	IPNM
IPNMDST000	Process Heat Non-metals Distillate Fuel Existing	INDOIL	IPNM
IPNMNGA000	Process Heat Non-metals Natural Gas Existing	INDNGA	IPNM
IPNMCOA000	Process Heat Non-metals Coal Existing	INDCOA	IPNM
IPNMCOK000	Process Heat Non-metals Coke Existing	INDCOK	IPNM
IPNMPTC000	Process Heat Non-metals Petroleum Coke Existing	INDPTC	IPNM
IPNMELC000	Process Heat Non-metals Electric Existing	INDELC	IPNM
IPNMLPG000	Process Heat Non-metals LPG Existing	INDLPG	IPNM
IPNMHET000	Process Heat Non-metals Heat Existing	INDHET	IPNM
IMNMHFO000	Machine Drive Non-metals Heavy Oil Existing	INDHFO	IMNM
IMNMDST000	Machine Drive Non-metals Distillate Oil Existing	INDOIL	IMNM
IMNMNGA000	Machine Drive Non-metals Natural Gas Existing	INDNGA	IMNM
IMNMCOA000	Machine Drive Non-metals Coal Existing	INDCOA	IMNM
IMNMELC000	Machine Drive Non-metals Electric Existing	INDELC	IMNM
IMNMLPG000	Machine Drive Non-metals LPG Existing	INDLPG	IMNM
IENMELC000	Electro-Chemical Process Non-metals Electric Existing	INDELC	IENM
IONMHFO000	Other Non-metals Heavy Oil Existing	INDHFO	IONM
IONMDST000	Other Non-metals Distillate Oil Existing	INDOIL	IONM
IONMNGA000	Other Non-metals Natural Gas Existing	INDNGA	IONM
IONMELC000	Other Non-metals Electric Existing	INDELC	IONM
IONMLPG000	Other Non-metals LPG Existing	INDLPG	IONM
IONMNGL000	Other Non-metals NGL Existing	INDNGL	IONM
IONMBIO000	Other Non-metals BIO Existing	INDBIO	IONM
IOI: Other industries			
IOI000	Existing Other Industries Tech	ISOI	IOI
ISOIHFO000	Steam Other Industry Heavy Oil Existing	INDHFO	ISOI
ISOIDST000	Steam Other Industry Distillate Oil Existing	INDOIL	ISOI
ISOINGA000	Steam Other Industry Natural Gas Existing	INDNGA	ISOI
ISOICOA000	Steam Other Industry Coal Existing	INDCOA	ISOI
ISOIELC000	Steam Other Industry Electric Existing	INDELC	ISOI
ISOILPG000	Steam Other Industry LPG Existing	INDLPG	ISOI
IPOIHFO000	Process Heat Other Industry Heavy Fuel Existing	INDHFO	IPOI
IPOIDST000	Process Heat Other Industry Distillate Fuel Existing	INDOIL	IPOI
IPOINGA000	Process Heat Other Industry Natural Gas Existing	INDNGA	IPOI
IPOICOA000	Process Heat Other Industry Coal Existing	INDCOA	IPOI
IPOIELC000	Process Heat Other Industry Electric Existing	INDELC	IPOI
IPOILPG000	Process Heat Other Industry LPG Existing	INDLPG	IPOI
IMOIHFO000	Machine Drive Other Industry Heavy Oil Existing	INDHFO	IMOI
IMOIDST000	Machine Drive Other Industry Distillate Oil Existing	INDOIL	IMOI
IMOINGA000	Machine Drive Other Industry Natural Gas Existing	INDNGA	IMOI
IMOICOA000	Machine Drive Other Industry Coal Existing	INDCOA	IMOI
IMOIELC000	Machine Drive Other Industry Electric Existing	INDELC	IMOI
IMOILPG000	Machine Drive Other Industry LPG Existing	INDLPG	IMOI
IEOIELC000	Electro-Chemical Process Other Industry Electric Existing	INDELC	IEOI
IOOIHFO000	Other All Other Industry Heavy Oil Existing	INDHFO	IOOI
IOOIDST000	Other All Other Industry Distillate Oil Existing	INDOIL	IOOI
IOOINGA000	Other All Other Industry Natural Gas Existing	INDNGA	IOOI
IOOICOA000	Other All Other Industry Coal Existing	INDCOA	IOOI
IOOIELC000	Other All Other Industry Electric Existing	INDELC	IOOI
IOOIHET000	Other All Other Industry Heat Existing	INDHET	IOOI
IOOIGEO000	Other All Other Industry Geothermal Existing	INDGEO	IOOI
IOOILPG000	Other All Other Industry LPG Existing	INDLPG	IOOI
IOOIBIO000	Other All Other Industry BIO Existing	INDBIO	IOOI
INOIHCO000	Non Energy Other Industry Hard CoalExisting	COAHCO	INOI
INOIOVC000	Non Energy Other Industry Ovencoke Existing	COAOVC	INOI
INOICRD000	Non Energy Other Industry Crude Oil Existing	OILCRD	INOI
INOINSP000	Non Energy Other Industry Non Specified Oil Existing	OILNSP	INOI
INOIPTC000	Non Energy Other Industry Petroleum Coke Existing	OILPTC	INOI
INOIWSP000	Non Energy Other Industry White Spirit Existing	OILWSP	INOI
INOILUB000	Non Energy Other Industry Lubricants Existing	OILLUB	INOI
INOIASP000	Non Energy Other Industry Asphalt Existing	OILASP	INOI
INOIWAX000	Non Energy Other Industry Paraffin Wax Existing	OILWAX	INOI
ONO: Other non specified energy consumption			
ONON000	Other non-specified consumption	IND***	ONO
I00: Very other industries			
I00000	Other Industrial consumption	INDCRD, INDNGA,	I00

Technology	Description	Commodity IN	Commodity OUT
		INDCOA, INDELC	

5.4.2 New technologies

The database contains a list of new technologies, available in 2005, which progressively replace the existing ones. The new technologies table is not presented here since there is only one new technology, available in 2005, associated with each industry. See the Excel workbook 'TechRep', for the list of new technologies by sector and their parameter values.

5.4.3 Technology naming conventions

The existing and the new technologies for demands are always identified with a six-character's code (e.g. ILP000):

- The first letter refers to the industry sector and is always I.
- The next two letters refer to the different industries, such as LP for Pulp and Paper.
- The last three digits refer to the year of the technology's first availability, which is always 000 for 2000 (existing technologies) or 005 for 2005 (new technologies).

The existing and the new technologies for energy services are always identified with a ten-character's code (e.g. IPLPDST000):

- The first four letters refer to the energy service, such as IPLP for Process heat in Pulp and Paper.
- The next three letters refer to the fuel consumed by the technology, such as DST for diesel.
- The last three digits refer to the year of the technology's first availability, which is always 000 for 2000 (existing technologies) or 005 for 2005 (new technologies).

The new technologies are identified with almost the same code (e.g. IPLPDST000 with IPLPDST005) and description (e.g. Process Heat Pulp and Paper Distillate Fuel Existing with Process Heat Pulp and Paper Distillate Fuel New).

These generic new technologies are in recognition of the complexity of energy use in an industrial plant. Each new technology represents the required amount of process heat, steam, machine drive, electrolytic service, and other category, and feedstocks per unit of industry output.

There are no new technologies associated with non-energy uses in other industries (INOI), other non-specified energy consumption (ONO) and very other industries (I00).

5.5 User-defined technology market share parameters and constraints

Same methodology as described in section 3.5 of this volume. In addition, constraints based on expert judgment in the industrial sector are described below.

There is one set of user constraints (User-defined constraints) in the industrial sector to control the relative fuel proportions (%) consumed in each energy service. They are built using the four letters code of the energy service and the three letters of the fuel (e.g. S_IPOINGA: MIN Share of NGA in IPOI). Moreover, one share USER CONSTRAINT limits the penetration of total geothermal in the overall industry (S_INDGEO: Max share IND Geothermal) and one absolute

USER CONSTRAINT limits the penetration of total coal for cogeneration (A_COACGEN: Max cogen from Coal). See Table A 6 in appendix for the complete list of User-defined constraints in the industrial sector and their description.

5.6 Auto-production and cogeneration in industry

First, auto-production of ELC has been allocated to industry (technologies beginning with EAELC and EAUT). These technologies produce INDELC (Table 21).

Table 21. Auto-production of electricity in the industrial sector

Technology	Description	Commodity IN	Commodity OUT
EAUTELC00	Autoproduction of Elc other than Cogen	INDNUC, INDHYD, INDSOL, INDTDL, INDWIN	INDELC
EAELCNGA00	Autoprod of ELC with NGA	INDNGA	INDELC
EAELCLPG00	Autoprod of ELC with LPG	INDLPG	INDELC
EAELCNGL00	Autoprod of ELC with NGL	INDNGL	INDELC
EAELCCOA00	Autoprod of ELC with COA	INDCOA	INDELC
EAELCCOK00	Autoprod of ELC with COK	INDCOK	INDELC
EAELCCOG00	Autoprod of ELC with COG	INDCOG	INDELC
EAELCBFG00	Autoprod of ELC with BFG	INDBFG	INDELC
EAELCOXY00	Autoprod of ELC with OXY	INDOXY	INDELC
EAELCHFO00	Autoprod of ELC with HFO	INDHFO	INDELC
EAELCOIL00	Autoprod of ELC with OIL	INDOIL	INDELC
EAELCETH00	Autoprod of ELC with ETH	INDETH	INDELC
EAELCNAP00	Autoprod of ELC with NAP	INDNAP	INDELC
EAELCPTC00	Autoprod of ELC with PTC	INDPTC	INDELC
EAELCBIO00	Autoprod of ELC with BIO	INDBIO	INDELC
EAELCGEO00	Autoprod of ELC with GEO	INDGEO	INDELC

Second, the CHP line of the IEA database refers to all electricity production and to heat production only if the heat is sold to third parties[1]. In case of a CHP plant that is owned by a refinery or a petrochemical industry, the CHP line in the IEA database does not cover the heat production or the fuel use for this heat production. Consequently, auto-production of electricity and heat has been directly allocated to industry and refinery, based on some exogenous assumptions needed to recalculate the fuel use and heat production from CHP.

It is not easy to reconstruct the fuel use and heat production by CHP from these data because there is no fixed power to heat ratio. Consequently, only heat sold to third parties can be calibrated to the IEA database.

In order to model the fuel use and heat production by industrial CHP from these data, the following assumptions have been made[2]:

- Inputs to and outputs of auto-CHP, as provided by IEA, were shared between sectors (exogenous ratios), including refineries.
- Heat production associated with electricity production, as provided by IEA, has been calculated based on the electricity/heat ratio (REH). These are exogenous values from IEA (Table 22[3]).

[1] Text from IEA database: “Note that for autoproducer's CHP plants, all fuel inputs to electricity production are taken into account, while only the part of fuel inputs to heat sold is shown. Fuel inputs for the production of heat consumed within the autoproducer's establishment are not included here but are included with figures for the final consumption of fuels in the appropriate consuming sector”.
[2] See IEA_Data sheet of Industrial templates to follow the detailed steps.
[3] These data are currently considered the same in all regions. They could be regionalized.

- Energy inputs associated to heat production have been calculated based on the efficiency of CHP (exogenous 0.8 for all sectors, all regions).
- Energy inputs to auto-CHP related to electricity production have been added to the industrial energy inputs (energy inputs related to heat auto-production do not need to be added as they are already included within the appropriate consuming sector).

Table 22. Ratio Electricity / Heat (CHP) by industry

Industrial segments (6)	Codes	REH
Iron and steel	IIS	0.417
Non ferrous metals	INF	0.222
Chemicals	ICH	0.333
Pulp and paper	ILP	0.256
Non metal minerals	INM	0.625
Other industries	IOI	0.435
Feedstocks	IFCH	0.345

Available industrial cogeneration technologies are included in Table 23. They produce both INDELC and IS** (IS** being heat consumed by each industrial sub-sector).

Table 23. Existing technologies for industrial cogeneration

Technology	Description	Commodity IN	Commodity OUT
IIS: Iron and steel			
ESISHFO000	Cogen, iron and steel, HFO, exist.	INDHFO	ISIS, INDELC
ESISNGA000	Cogen, iron and steel, NGA, existing	INDNGA	ISIS, INDELC
ESISCOA000	Cogen, iron and steel, COA, existing	INDCOA	ISIS, INDELC
ESISBFG000	Cogen, iron and steel, BFG, existing	INDBFG	ISIS, INDELC
INF: Non ferrous metals			
ESNFHFO000	Cogen, non-ferrous metals, HFO, exist.	INDHFO	ISNF, INDELC
ESNFNGA000	Cogen, non-ferrous metals, NGA, existing	INDNGA	ISNF, INDELC
ESNFCOA000	Cogen, non-ferrous metals, COA, existing	INDCOA	ISNF, INDELC
ICH: Chemicals			
ESCHHFO000	Cogen, chemicals, HFO, exist.	INDHFO	ISCH, INDELC
ESCHNGA000	Cogen, chemicals, NGA, existing	INDNGA	ISCH, INDELC
ESCHCOA000	Cogen, chemicals, COA, existing	INDCOA	ISCH, INDELC
ILP: Pulp and paper			
ESLPHFO000	Cogen, pulp and paper, HFO, exist.	INDHFO	ISLP, INDELC
ESLPNGA000	Cogen, pulp and paper, NGA, existing	INDNGA	ISLP, INDELC
ESLPCOA000	Cogen, pulp and paper, COA, existing	INDCOA	ISLP, INDELC
ESLPBIO000	Cogen, pulp and paper, BIO, existing	INDBIO	ISLP, INDELC
INM: Non metal minerals			
ESNMHFO000	Cogen, non-metals, HFO, exist.	INDHFO	ISNM, INDELC
ESNMNGA000	Cogen, non-metals, NGA, existing	INDNGA	ISNM, INDELC
ESNMCOA000	Cogen, non-metals, COA, existing	INDCOA	ISNM, INDELC
IOI: Other industries			
ESOIHFO000	Cogen, other industries, HFO, exist.	INDHFO	ISOI, INDELC
ESOINGA000	Cogen, other industries, NGA, existing	INDNGA	ISOI, INDELC
ESOICOA000	Cogen, other industries, COA, existing	INDCOA	ISOI, INDELC

Two levels of user-defined constraints are used for cogeneration.

- First, one set of user-defined constraints is used to determine the relative proportions of boilers and CHP technologies in the steam energy service (IS**) of each industry.
  - S_ISNFCHP: Min share of steam technologies (IS) in ISNF
  - S_ESNFCHP: Min share of CHP (ES) in ISNF
- Second, two sets of user-defined constraints are used to determine the relative fuel proportion for boilers (IS**) and for CHP technologies (ES**) in each industry.
  - S_ISNFHFO: MIN Share of HFO in ISNF
  - S_ESNFHFO: MIN Share of HFO in ESNF

Table A 7 provides a complete list of user-defined constraints for industrial cogeneration.

6. Electricity production

The electricity sector covers electricity production, heat production and cogeneration. Auto-production of electricity in the industrial sector and heat by power plants or by cogeneration is excluded from the electricity sector and is included in concerned sectors (Industry and Refinery – see sections 5.6 and 7.5).

6.1 Fuels

The different fuels used by the electricity sector are aggregated into 15 different categories (Table 24), including fossil fuels, biomass fuels, non-fossil fuels (hydro, nuclear, renewables) and dual fuels. Aggregation ratios are based on data provided by the IEA database. The user may decide to change them.

Table 24. Technologies created to produce industry sector fuels

Technology	Description	Commodity IN [a]	Commodity OUT [b]
ELCNGA000	Fuel Tech - Natural Gas (ELC)	GASGWG GASBFG GASCOG GASOXY GASNGA GASRFG GASLPG	ELCNGA
ELCOIL000	Fuel Tech - Oil (ELC)	OILCRD OILDST OILGSL OILNAP OILNGL OILNSP OILKER OILHFO OILPTC	ELCOIL
ELCCOA000	Fuel Tech - Coal (ELC)	COABCO COAHCO COAOVC	ELCCOA
ELCNUC000	Fuel Tech - Uranium (ELC)	DMYNUC	ELCNUC
ELCHYD000	Fuel Tech - Hydro (ELC)	HYD	ELCHYD
ELCGEO000	Fuel Tech - Geothermal (ELC)	GEO	ELCGEO
ELCSOL000	Fuel Tech - Solar (ELC)	SOL	ELCSOL
ELCTDL000	Fuel Tech - Tide (ELC)	TDL	ELCTDL
ELCWIN000	Fuel Tech - Wind (ELC)	WIN	ELCWIN
ELCBIO000	Fuel Tech - Biofuels (ELC)	BIOBLQ BIOBIN BIOBMU BIOBSL	ELCBIO
ELCGOIG00	Fuel Tech - Gas to GAS+OIL (ELC)	GASNGA	ELCGOI
ELCGOIO00	Fuel Tech - Oil to GAS+OIL (ELC)	OILDST	ELCGOI
ELCCGOG00	Fuel Tech - Natural Gas to COAL+GAS+OIL (ELC)	GASNGA	ELCCGO
ELCCGOO00	Fuel Tech - Heavy Fuel Oil to COAL+GAS+OIL (ELC)	OILHFO	ELCCGO
ELCCGOH00	Fuel Tech - Hard Coal to COAL+GAS+OIL (ELC)	COAHCO	ELCCGO
ELCCGOB00	Fuel Tech - Brown Coal to COAL+GAS+OIL (ELC)	COABCO	ELCCGO
ELCNGA111 [c]	Fuel Tech - Natural Gas (ELC)	GASNGA	ELCNGA
ELCOIL111 [c]	Fuel Tech - Oil (ELC)	OILHFO	ELCOIL
ELCBIO111 [c]	Fuel Tech - Biofuels (ELC)	BIOBSL	ELCBIO
ELCBGS111 [d]	Fuel Tech - Biogas (ELC)	BIOGAS	ELCBGS
ELCBMU111 [d]	Fuel Tech - Municipal waste (ELC)	BIOBMU	ELCBMU
ELCSBC111 [d]	Fuel Tech - Solid biomass (ELC)	BIOSLD	ELCSLD
ELCCRP111 [c]	Fuel Tech - Crop (ELC)	BIOCRP	ELCCRP

[a] See section 7 for description of these commodities.

[b] ELCGOI is a dual fuel produced from either OILDST or GASNGA. ELCCGO is a dual fuel produced from either GASNGA, OILHFO, COAHCO or COABCO.
[c] These technologies are to relax the specific mix of fuels that might have been in use in the base year.
[d] These technologies are used for new ELC plants.

6.2 Technologies

Existing power plants, cogeneration and heat plants (Table 25) are characterized by their installed capacity, efficiency, annual utilization or capacity factor, lifetime, fixed and variable operation costs, and a peak parameter. The peak parameter limits the use of a technology to meet peak electricity demand. No investment is allowed in the existing technologies. The activity of technologies in 2000 has a lower bound to approximate historical generation patterns. New technologies have the same types of parameters, plus investment cost and date of first availability. Table 26 describes new technologies.

Table 25. Existing power plants, CHP and heat plants for electricity production

Technology	Description
Thermal plants	
EOILST100	EPLT: .G1.00.CON.OIL.Oil Steam.Existing.
EOILIC100	EPLT: .G1.00.CON.OIL.Oil Internal Combustion.Existing.
EOILCC100	EPLT: .G1.00.CON.OIL.Oil Comb Cycle.Existing.
EGASST100	EPLT: .G1.00.CON.NGA.Gas Steam.Existing.
EGASCT100	EPLT: .G1.00.CON.NGA.Gas Turbine.Existing.
EGASCC100	EPLT: .G1.00.CON.NGA.Gas Comb Cycle.Existing.
ECOACON100	EPLT: .G1.00.CON.COA.Pulvarized Coal.Existing.
ECOAFLB100	EPLT: .G1.00.CON.COA.Fluidized Bed Coal.Existing.
ECOAGCC100	EPLT: .G1.00.ADV.COA.IGCC.Existing.
Hydro	
EGHDR100	EPLT: .G1.00.CON.HYD.Run of river.Existing.
EGHDD100	EPLT: .G1.00.CON.HYD.With dam.Existing.
Nuclear (generic)	
EGNUC100	EPLT: .G1.00.CON.NUC.Existing.
Renewables	
EGGEO100	EPLT: .G1.00.CON.GEO.Existing.
EGSOL100	EPLT: .G1.00.CON.SOL.Existing.
EGTID100	EPLT: .G1.00.CON.TID.Existing.
EGWIN100	EPLT: .G1.00.CON.WIN.Existing.
EGBIO100	EPLT: .G1.00.CON.BIO.Existing.
Heat plants (generic)	
HETGGAS00	HPLT: .G1.00.CON.GAS.Existing.
HETGOIL00	HPLT: .G1.00.CON.OIL.Existing.
HETGBIO00	HPLT: .G1.00.CON.BIO.Existing.
HETGCOA00	HPLT: .G1.00.CON.COA.Existing.
HETGGEO00	HPLT: .G1.00.CON.GEO.Existing.
HETGSOL00	HPLT: .G1.00.CON.SOL.Existing.
CHP (generic)	
CHPGGAS100	CHP: .G1.00.CON.GAS.Public.Existing.
CHPGOIL100	CHP: .G1.00.CON.OIL.Public.Existing.
CHPGCOA100	CHP: .G1.00.CON.COA.Public.Existing.
CHPGGEO100	CHP: .G1.00.CON.GEO.Public.Existing.
CHPGBIO100	CHP: .G1.00.CON.BIO.Public.Existing.

Table 26. New plants for electricity production[a]

Technology	Description
Oil	
EOILGBL105	EPLT: .G1.05.CON.OIL.Generic Dist Gen for Base Load.
EOILGPL105	EPLT: .G1.05.CON.OIL.Generic Dist Gen for Peak Load.
EOILSTE105	EPLT: .G1.05.CON.OIL.Oil Steam.
Gas	
EGASFCE105	EPLT: .G1.05.ADV.NGA.Fuel Cells.
EGASSTE105	EPLT: .G1.05.CON.NGA.Gas Steam.

Coal	
ECOAAFB105	EPLT:G1.05.ADV.COA.Atmospheric Fl Bed.
ECOACCA105	EPLT: .G1.05.ADV.COA.Air Blown IGCC.
ECOACCO105	EPLT: .G1.05.ADV.COA.Oxygen Blown IGCC.
ECOAPFB105	EPLT:G1.05.ADV.COA.Pressurized Fl Bed.
ECOAPUL105	EPLT: .G1.05.CON.COA.Pulverized Coal.
Mix Oil/Gas	
EGOICCA105	EPLT: .G1.05.ADV.GOI.Gas/Oil Comb Cycle.
EGOICCY105	EPLT: .G1.05.CON.GOI.Gas/Oil Comb Cycle.
EGOITUA105	EPLT: .G1.05.ADV.GOI.Advanced Gas/Oil Turbine.
EGOITUR105	EPLT: .G1.05.CON.GOI.Gas/Oil Turbine.
Hydro	
EHYDDAM105	EPLT: .G1.05.CON.HYD.Generic Impoundment Hydro.
EHYDRUN105	EPLT: .G1.05.CON.HYD.Generic ROR Hydro.
Nuclear	
ENUCADV105	EPLT: .G1.05.ADV.NUC.Advanced Nuclear.
ENUCLWR105	EPLT: .G1.05.ADV.NUC.Advanced Nuclear LWR.
ENUCPBM110	EPLT: .G1.10.ADV.NUC.Advanced Nuclear PBMR.
Biomass	
EBIOCRC105	EPLT: .G1.05.CON.BIO.Crop Direct Combustion.
EBIOCRG105	EPLT: .G1.05.CON.BIO.Crop Gasification.
EBIOGAW105	EPLT: .G1.05.CON.BIO.Biogas from Waste.
EBIOMSW105	EPLT: .G1.05.CON.BIO.MSW Direct Combustion.
EBIOSLC105	EPLT: .G1.05.CON.BIO.Sld Biomass Direct Combustion.
EBIOSLG105	EPLT: .G1.05.CON.BIO.Sld Biomass Gasification.
Geothermal	
EGEOBIN105	EPLT: .G1.05.CON.GEO.Binary Geo.
EGEOFLA105	EPLT: .G1.05.CON.GEO.Flash Steam Geo.
EGEOROC110	EPLT: .G1.10.CON.GEO.HotDryRock1 Geo.
Solar	
ESOLPVB105	EPLT: .G1.05.CON.SOL.PV.Solar PV w Backup.
ESOLPVN105	EPLT: .G1.05.CON.SOL.PV.Solar PV no Backup.
ESOLTWB105	EPLT: .G1.05.CON.SOL.Solar Thermal w Backup.
Wind	
EWINNBU105	EPLT: .G1.05.CON.WIN.Wind no Backup.
EWINWBU105	EPLT: .G1.05.CON.WIN.Wind w Backup.
Heat	
HETBIOP105	HPLT: .05.CON.BIO.
HETCOAP105	HPLT: .05.CON.COA.
HETGASP105	HPLT: .05.CON.NGA.
HETGEOP105	HPLT: .05.CON.GEO.
HETOILP105	HPLT: .05.CON.OIL.

[a] No new CHP plant is included. This means that all new cogeneration investments are expected to occur in end-use sectors.

6.3 User-defined technology market share parameters and constraints

Same methodology described in section 3.5 of this volume. Electricity specific constraints are described below. Table 27 shows the user-defined constraints that are used to guide electricity production. Some user-defined constraints are not used in some regions. As explained in previous sections, 2005 values of share user-defined constraints are calculated from the base year information (2000) and from a relaxation factor, which decreases over time in order to give more and more flexibility to the model at later time periods.

Table 27. User-defined constraints in the electricity sector

CONSTRAINT	Description
Absolute User-defined constraints	
A_HYDCAP	Max HYD Capacity
A_NUCGEN	Fixed NUC Generation
A_GEOHCAP	Max GEO Capacity (heat production)
Share User-defined constraints	
S_ELCTHERM	Thermal as a share of non-hydro non-nuc production
S_ELCRENEW	Renewable as a share of non-hydro non-nuc production
S_THERMCOA	Coal as a share of total thermal fuel consumption
S_THERMGAS	Gas as a share of total thermal fuel consumption

S_THERMOIL	Oil as a share of total thermal fuel consumption
S_RENEWWIN	Wind as a share of total renewable ELC production
S_RENEWSOL	Solar as a share of total renewable ELC production
S_RENEWGEO	Geo as a share of total renewable ELC production
S_RENEWBIO	Bio as a share of total renewable ELC production
S_RENEWTDL	Tidal as a share of total renewable ELC production
S_ETCOACON	Minimum share of conventional coal elc techs
S_ETGASCON	Minimum share of conventional gas elc techs
S_ETOILCON	Minimum share of conventional oil elc techs
S_ETGOICON	Minimum share of conventional gas/oil elc techs
S_ETCOAADV	Minimum share of advanced coal elc techs
S_ETGASADV	Minimum share of advanced gas elc techs
S_ETOILADV	Minimum share of advanced oil elc techs
S_ETGOIADV	Minimum share of advanced gas/oil elc techs

Moreover, all existing power plants, except for nuclear plants, are driven by lower bounds on their activity (nuclear plants are driven by an absolute constraint on generation).

6.4 International trade

The modeler defines allowable trade links between regions for energy products (and potentially carbon permits). Electricity is handled in this manner; however, many possible electricity links do not make any sense (Electricity export from Mexico to Australia, for example).

7. Upstream / Downstream

Data related to fossil energy production, trade, and downstream use (coal mining, oil drilling, etc.) are separated for OPEC / Non-OPEC countries in each region. SAGE recognizes OPEC data by the letter P inserted in the commodity or technology name, while Non-OPEC data are recognized by the letter N (e.g. OI**N**CRD Crude oil – Nopec). By default, when a region includes no OPEC countries, names are coded as Non-OPEC countries. OPEC and Non-OPEC energy commodities are merged to meet energy service demand.

No new technologies are included in upstream / downstream sectors but investments in existing technologies are allowed to expand production capacity..

7.1 Biomass[1]

Data for many different types of biomass are available from the IEA database and EIA data (Table 28). Biomass technologies compete directly at energy service demand level.

Table 28. Different types of biomass

Commodity	Description	Origins / Uses
Primary biomass		
BIOSLD [a]	Solid Biomass	- Converted to solid biomass (BIOBSL) consumed by end-use sectors - Consumed by new power plants
BIOBIN	Industrial wastes	- Consumed by end-use sectors, upstream sector and/or new power plants
BIOBMU	Municipal wastes	- Consumed by end-use sectors, upstream sector and/or new power plants
BIOGAS	Biogas (landfill)	- Converted to Gas-Liq biofuels (BIOBLQ) consumed by end-use sectors - Consumed by new power plants and by industry
BIOLIQ	Biofuels (liquids)	- Consumed by transportation sector (ethanol and methanol) - Converted to Gas-Liq biofuels (BIOBLQ) consumed by end-use sectors
BIOCRP	Energy crop	- Converted to solid biomass (BIOBSL) consumed by end-use sectors - Converted to ethanol (BIOETH) consumed by transportation sector

[1] OPEC and Non-OPEC are not separated.

		- Consumed by new elc power plants
Secondary biomass		
BIOBLQ	Gas-Liq biofuels	- Produced from BIOLIQ and BIOGAS - Consumed by end-use sectors
BIOETH	Ethanol from crop	- Produced from BIOCRP - Consumed by transportation sector (ethanol)
BIOCHR	Charcoal	- Produced from BIOBSL - Consumed by end-use sectors
BIOBSL	Solid biomass (end-use)	- Produced from BIOSLD and BIOCRP - Consumed by end-use sectors

[a] Three different resources costs are available.

7.2 Fossil resources and primary production

7.2.1 Fossil resources

Fossil resource naming conventions and descriptions are presented in Table 29. They are modeled as follows:

- First, three types of each resource is defined: located reserves, reserves growth and new discovery – unconventional and unconnected gas are also added;
- Second, a three-step supply curve for each type of resource is defined. Each step is characterized by the cost of the resource and the amount of energy (annual) available at this cost.

Table 29. Fossil resources and fossil fuels[1]

Reserves	Description	Commodity OUT	Description
Located reserves and producing pools: the volume is the remaining resource volume in 2000			
MINOINLIG1	Light oil (ground) - Located reserves - Step 1 - Nopec	OINLIG	Light oil (ground) - Nopec
MINOINLIG2	Light oil (ground) - Located reserves - Step 2 - Nopec	OINLIG	
MINOINLIG3	Light oil (ground) - Located reserves - Step 3 - Nopec	OINLIG	
MINOINHEA1	Heavy oil (ground) - Located reserves - Step 1 - Nopec	OINHEA	Heavy oil (ground) - Nopec
MINOINHEA2	Heavy oil (ground) - Located reserves - Step 2 - Nopec	OINHEA	
MINOINHEA3	Heavy oil (ground) - Located reserves - Step 3 - Nopec	OINHEA	
MINOINSAN0	Oil sands (mined - synth) – Located reserves - Nopec	OINSAN	Oil sands (mined - synth) - Nopec
MINOINOBI1	Oil sands (in situ - ultra hvy) - Located reserves - Step 1 - Nopec	OINOBI	Oil sands (in situ - ultra hvy) - Nopec
MINOINOBI2	Oil sands (in situ - ultra hvy) - Located reserves - Step 2 - Nopec	OINOBI	
MINOINOBI3	Oil sands (in situ - ultra hvy) - Located reserves - Step 3 - Nopec	OINOBI	
MINOINOSH1	Shale oil (ground) - Located reserves - Step 1 - Nopec	OINOSH	Shale oil (ground) - Nopec
MINOINOSH2	Shale oil (ground) - Located reserves - Step 2 - Nopec	OINOSH	
MINOINOSH3	Shale oil (ground) - Located reserves - Step 3 - Nopec	OINOSH	
MINGANNAT1	Natural gas (ground) - Located reserves - Step 1 - Nopec	GANNAT	Natural gas (ground) - Nopec
MINGANNAT2	Natural gas (ground) - Located reserves - Step 2 - Nopec	GANNAT	
MINGANNAT3	Natural gas (ground) - Located reserves - Step 3 - Nopec	GANNAT	
MINCONBRO0	Brown coal (ground) - Located reserves - Nopec	CONBRO	Brown coal (ground) - Nopec
MINCONHAR0	Hard coal (ground) - Located reserves - Nopec	CONHAR	Hard coal (ground) - Nopec
Enhanced recovery: Reserves growth			
MINOINLIG4	Light oil (ground) - Reserves growth - Step 1 - Nopec	OINLIG	Light oil (ground) - Nopec
MINOINLIG5	Light oil (ground) - Reserves growth - Step 2 - Nopec	OINLIG	
MINOINLIG6	Light oil (ground) - Reserves growth - Step 3 - Nopec	OINLIG	
MINOINHEA4	Heavy oil (ground) - Reserves growth - Step 1 - Nopec	OINHEA	

[1] Similar data exist for OPEC countries where needed.

Reserves	Description	Commodity OUT	Description
MINOINHEA5	Heavy oil (ground) - Reserves growth - Step 2 - Nopec	OINHEA	Heavy oil (ground) - Nopec
MINOINHEA6	Heavy oil (ground) - Reserves growth - Step 3 - Nopec	OINHEA	
MINGANNAT4	Natural gas (ground) - Reserves growth - Step 1 - Nopec	GANNAT	Natural gas (ground) - Nopec
MINGANNAT5	Natural gas (ground) - Reserves growth - Step 2 - Nopec	GANNAT	
MINGANNAT6	Natural gas (ground) - Reserves growth - Step 3 - Nopec	GANNAT	
MINOINSAN1	Oil sands (mined bitumen) - Enhanced recovery - Nopec	OINSAN	Oil sands (mined - synth) - Nopec
MINOINOBI4	Oil sands (in-situ - ultra hvy) - Enhanced recovery - Step 1 -Nopec	OINOBI	Oil sands (in situ - ultra hvy) - Nopec
MINOINOBI5	Oil sands (in-situ - ultra hvy) - Enhanced recovery - Step 2 -Nopec	OINOBI	
MINOINOBI6	Oil sands (in-situ - ultra hvy) - Enhanced recovery - Step 3 -Nopec	OINOBI	
New discovery			
MINOINLIG7	Light oil (ground) - New discovery - Step 1 - Nopec	OINLIG	Light oil (ground) - Nopec
MINOINLIG8	Light oil (ground) - New discovery - Step 2 - Nopec	OINLIG	
MINOINLIG9	Light oil (ground) - New discovery - Step 3 - Nopec	OINLIG	
MINOINHEA7	Heavy oil (ground) - New discovery - Step 1 - Nopec	OINHEA	Heavy oil (ground) - Nopec
MINOINHEA8	Heavy oil (ground) - New discovery - Step 2 - Nopec	OINHEA	
MINOINHEA9	Heavy oil (ground) - New discovery - Step 3 - Nopec	OINHEA	
MINOINSAN2	Oil sands (mined bitumen) - New discovery - I - Nopec	OINSAN	Oil sands (mined - synth) - Nopec
MINGANNAT7	Natural gas (ground) - New discovery - Step 1 - Nopec	GANNAT	Natural gas (ground) - Nopec
MINGANNAT8	Natural gas (ground) - New discovery - Step 2 - Nopec	GANNAT	
MINGANNAT9	Natural gas (ground) - New discovery - Step 3 - Nopec	GANNAT	
MINCONBRO1	Brown coal (ground) - New discovery - Nopec	CONBRO	Brown coal (ground) - Nopec
MINCONHAR1	Hard coal (ground) - New discovery - Nopec	CONHAR	Hard coal (ground) - Nopec
Unconventional and not connected gas			
MINGANNATU	Natural gas (ground) - Unconventional - Nopec	GANNAT	Natural gas (ground) - Nopec
MINGANNATN	Natural gas (ground) - Not connected - Nopec	GANNAT	

7.2.2 Primary production

Primary production technologies, including energy consumption, flaring and venting, are listed in Table 30.

Table 30. Primary production technologies[1]

Technology	Description	Commodity OUT [a]	Description
UPRNOL100	Prod of Light Oil - Step 1 - Exist – Nopec	OINCRL	Crude oil - light - Nopec
UPRNOL200	Prod of Light Oil - Step 2 - Exist – Nopec		
UPRNOL300	Prod of Light Oil - Step 3 - Exist – Nopec		
UFLNOL00	Flaring and Venting - Light Oil - Exist - Nopec		
UPRNOH100	Prod of Heavy Oil - Step 1 - Exist – Nopec	OINCRH	Crude oil - heavy - Nopec
UPRNOH200	Prod of Heavy Oil - Step 2 - Exist – Nopec		
UPRNOH300	Prod of Heavy Oil - Step 3 - Exist – Nopec		
UFLNOH00	Flaring and venting - Heavy Oil - Exist - Nopec		
UPRNOS100	Prod of Synth Oil (mined) - Step 1 - Exist - Nopec	OINNCR	Synthetic oil (from mined bitumen + liquefac) - Nopec
UPRNOS200	Prod of Synth Oil (mined) - Step 2 - Exist - Nopec		
UPRNOS300	Prod of Synth Oil (mined) - Step 3 - Exist - Nopec		
UFLNOS00	Flaring and venting - Oil Sands - Exist - Nopec		

[1] Similar data exist for OPEC countries where needed.

UPRNUH100	Prod of Ultra Hvy Oil - Step 1 - Exist – Nopec [b]	OINUHV	Ultra heavy oil (from in-situ bitumen) - Nopec
UPRNUH200	Prod of Ultra Hvy Oil - Step 2 - Exist – Nopec [b]		
UPRNUH300	Prod of Ultra Hvy Oil - Step 3 - Exist – Nopec [b]		
UPRNSH100	Prod of Shale Oil - Step 1 - Exist – Nopec	OINSHA	Shale oil - Nopec
UPRNSH200	Prod of Shale Oil - Step 2 - Exist – Nopec		
UPRNSH300	Prod of Shale Oil - Step 3 - Exist – Nopec		
UPRNG100	Field + Gas Plant - Step 1 - Exist – Nopec	GANNGA	Natural gas – Nopec
		OINNGL	Natural gas liquids - Nopec
UPRNG200	Field + Gas Plant - Step 2 - Exist – Nopec		
UPRNG300	Field + Gas Plant - Step 3 - Exist – Nopec		
UFLNG00	Flaring and venting - Nat Gas - Exist – Nopec		
UPRNCH100	Prod of Hardcoal - Step 1 - Exist – Nopec	CONHCO	Hard coal - Nopec
UPRNCH200	Prod of Hardcoal - Step 2 - Exist – Nopec		
UPRNCH300	Prod of Hardcoal - Step 3 - Exist – Nopec		
UPRNCB100	Prod of Browncoal - Step 1 - Exist – Nopec	CONBCO	Brown coal - Nopec
UPRNCB200	Prod of Browncoal - Step 2 - Exist – Nopec		
UPRNCB300	Prod of Browncoal - Step 3 - Exist – Nopec		
UPRNG2L100	Gas to LNG – Nopec	GANLNG	LNG - Nopec
UPRNL2G100	LNG to Gas – Nopec	GANNGA	Natural gas – Nopec
UOGPIPN00	Existing oil and gas pipelines – Nopec		

[a] Only the most important output is included here
[b] From OINOBI

Several remarks are in order:

- OINSHA, OINNCR, OINNGL, OINCRL, OINCRH, OINUHV are considered as equivalent to OINCRD (conversion by technologies UCRN_SHA00, UCRN_NCR00, UCRN_NGL00, UCRN_CRL00, UCRN_CRH00, UCRN_UHV00);
- Natural gas liquids (NGL) are produced by gas plants (UPRNG* technologies); they are not included in reserves;
- Flared gas and vented gas are modeled as outputs of each primary production technology; they are then converted into emissions by the UFLN* technologies.
- Liquefied natural gas is available. UPRNG2L100 and UPRNL2G100 convert natural gas into LNG and LNG into natural gas. International trade of both natural gas and LNG is available.
- Distribution losses are modeled by existing oil and gas pipelines UOGPIPN00. This technology is activated by the constraint S_PIPLIN.

7.3 Secondary transformation

7.3.1 Oil Refining

The oil-refining sector is currently represented by a single flexible refinery (UTRNREFX00). Its capacity is calculated from IEA statistics. The refinery converts inputs such as crude oil, NGL, feedstocks, additives, etc. into refined petroleum products such as gasoline, LPG, and distillates for the end-use sectors and for the electricity sector.

7.3.2 Other transformation processes

Other transformation processes are listed in
Table 31.

Table 31. Other secondary transformation technologies[1]

Technology	Description	Commodity OUT [a]	Description
UTRNHEAT00	THEAT- Heatpumps - Nopec	UPNHET	Heat (UPS) - Nopec
UTRNBOIL00	TBOILER- Electric boilers - Nopec	UPNHET	Heat (UPS) - Nopec
UTRNCKOV00	TCOKEOVS- Pd coke and coke-oven-gas – Nopec	CONOVC GANCOG	Coke oven coke – Nopec Coke oven gas - Nopec
UTRNGWKS00	TGASWKS- Prod of town gas - Nopec	GANGWG CONGSC	Gas works gas – Nopec Gas coke - Nopec
UTRNBLSFU0	BLASTFUR- Blast furnace - Nopec	GANBFG GANOXY	Blast furnace gas – Nopec Oxygen steel furnace gas - Nopec
UTRNPETC00	PETCHEM- Petrochemicals/Refinery – Nopec	OINFEE	Refinery feedstock - Nopec
UTRNLIQU00	LIQUEFAC,ELNG- Liquef processes - Nopec	GANLPG OINNCR GANETH	Liquid petroleum gas – Nopec Synthetic oil (from mined bitumen + liquefac) – Nopec Ethane - Nopec
UTRNNSPC00	TNONSPEC, TCHARCOAL- Transfo non spec - Nopec	BIOCHR	Charcoal
USTOCKCN00	Stock changes - Exist - Nopec	[b]	
USTATDIN00	Stat differences - Exist - Nopec	[c]	
UTRANSFN00	Transfer - Exist - Nopec	[d]	

[a] Only the most important output are included here
[b] Inputs and outputs may vary between regions. This technology, based on IEA database, reflects the difference between opening stock levels on the first day of the year and closing levels on the last day of the year of stocks on national territory held by producers, importers, energy transformation industries and large consumers.
[c] Inputs and outputs may vary between regions. This technology, based on IEA database, includes the sum of the unexplained statistical differences for individual fuels, as they appear in the basic energy statistics. It also includes the statistical differences that arise because of the variety of conversion factors in the coal and oil columns.
[d] Inputs and outputs may vary between regions. This technology, based on IEA database, includes inter-product transfers, products transferred and recycled products (e.g. used lubricants which are reprocessed).

7.4 Cogeneration in the oil refining sector

As explained in section 5.6 (Cogeneration in Industry), it is not easy to reconstruct the fuel use and heat production by CHP from available data.

In the upstream sector, production of heat and electricity by cogeneration (from refined petroleum products, natural gas and coal) is available, based on IEA statistics and exogenous assumptions (REH=0.385; Efficiency=0.8).

Finally, several technologies of upstream sector consume heat (UPNHET and UPPHET). Because heat cannot be an input to a process technology, this heat was not taken into account by the model. This defect is corrected in the new version of the database.

7.5 International trade of biomass and fossil commodities

International trade is modeled for all energy commodities and it includes OPEC/Non-OPEC commodities. A scenario using SAGE may handle trade either exogenously or endogenously. If trade is exogenous then:

- Imports have an exogenous non-zero cost based on EIA data;

[1] Similar data exist for OPEC countries where needed.

- Exports are bounded (maximum amounts) and no costs are associated with them in order to avoid extra-exports that could occur in regions with fossil fuel reserves (exports “to make money” as these exports are not connected to an importing region);
- Trading level estimates are based on EIA data.

If trade is endogenous, SAGE solves for equilibrium prices that include user-defined constraints to smooth evolving trade patterns.

8. GHG Emissions

Emission coefficients for CO_2, CH_4 and N_2O are included in SAGE for each sector fuel (AGR*, RES*, COM*, TRA*, IND*, ELC*, UPS*) according to the emission coefficients found in the literature for each disaggregated fuel and their proportional input in each sector fuel. Emissions are reported directly at the technology level and at the sector level. These coefficients may be modified by the modeler with the VEDA SAGE software.

Sector emissions are converted into CO_2-equivalent (GHG parameter) by using their Global Warming Potential (21 for CH_4 and 310 for N_2O). Sector CO_2 emissions are aggregated to total CO_2 ($TOTCO_2$ parameter).

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Appendix A

Table A 1. List of countries in each region

Individual countries	Western Europe (WEU)	Former Soviet Union (FSU)	Eastern Europe (EEU)	Central and South America (CSA)	Other Developing Asia (ODA)	Africa AFR)	Middle East (MEA)
Canada (CAN)	Austria	Armenia	Albania	Argentina	Bangladesh	Algeria	Bahrain
United States (USA)	Belgium	Azerbaijan	Bosnia-Herzegovina	Bolivia	Brunei	Angola	Cyprus
Mexico (MEX)	Denmark	Belarus	Bulgaria	Brazil	Chinese Taipei	Benin	Iran
India (IND)	Finland	Estonia	Croatia	Chile	Indonesia	Cameroon	Iraq
China (CHI)	France[a]	Georgia	Czech Rep	Colombia	North Korea	Congo B	Israel
Japan (JPN)	Germany	Kazakhstan	Hungary	Costa Rica	Malaysia	Congo Rep K	Jordan
Australia-NZ (AUS)	Gibraltar	Kyrgyzstan	Macedonia	Cuba	Myanmar	Cote d'Ivoire	Kuwait
South Korea (SKO)	Greece	Latvia	Poland	Dominican Rep	Nepal	Egypt	Lebanon
	Greenland	Lithuania	Romania	Ecuador	Other Asia[e]	Ethiopia	Oman
	Iceland	Moldova	Slovakia	El Salvador	Pakistan	Gabon	Qatar
	Ireland	Russia	Slovenia	Guatemala	Philippines	Ghana	Saudi Arabia
	Italy[b]	Tajikistan	Yugoslavia	Haiti	Singapore	Kenya	Syria
	Luxembourg	Turkmenistan		Honduras	Sri Lanka	Libya	Turkey
	Malta	Ukraine		Jamaica	Thailand	Morocco	United Arab Emirates
	Netherlands	Uzbekistan		Netherlands Antilles	Vietnam	Mozambique	Yemen
	Norway			Nicaragua		Nigeria	
	Portugal			Other Latin America[d]		Other Africa[f]	
	Spain			Panama		Senegal	
	Sweden			Paraguay		South Africa	
	Switzerland[c]			Peru		Sudan	
	United Kingdom			Trinidad-Tobago		Tanzania	
				Uruguay		Tunisia	
				Venezuela		Zambia	
						Zimbabwe	

[a] Includes Monaco.
[b] Includes San Marino and Vatican City
[c] Includes Liechtenstein
[d] Included: Antigua and Barbuda, Bahamas, Barbados, Belize, Bermuda, Dominica, French Guiana, Grenada, Guadeloupe, Guyana, Martinique, St. Kitts and Nevis, St. Lucia, St. Vincent and Grenadines, Suriname. Excluded due to lack of data: Aruba, British Virgin Islands, Cayman Islands, Falkland Island, Montserrat, St. Pierre and Miquelon, Turks and Caicos Islands.
[e] Included: Afghanistan, Bhutan, Fiji, French Polynesia, Kiribati, Maldives, New Caledonia, Papua-New-Guinea, Samoa, Solomon Islands, Vanuatu. Excluded due to lack of data: American Samoa, Cambodia, Christmas Island, Cook Islands, Laos, Macau, Mongolia, Nauru, Niue, Pacific Islands, Tonga, Wake Island.
[f] Included: Botswana, Burkina Faso, Burundi, Cape Verde, Central African Republic, Chad, Djibouti, Equatorial Guinea, Gambia, Guinea, Guinea-Bissau, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Niger, Reunion, Rwanda, Sao Tome and Principe, Seychelles, Sierra Leone, Somalia, Swaziland, Togo, Uganda. Excluded due to lack of data: Comoros, Namibia, St. Helena, Western Sahara.

Table A 2. Comprehensive list of model parameters

Parameter	Description
(E)DISTINV	Electric distribution investment cost
(E)DISTOM	Electric distribution O&M cost
(E)LCFEQ	Fossil equivalent
(E)RESERV	Reserve capacity fraction
AF	Annual availability
AF(Z)(Y)	Availability for season, time of day
ARAF	Annual reservoir availability
BAS(E)LOAD	Baseload fraction of total night production
BOUND(BD)	Bound on capacity
BOUND(BD)O	Bound on activity: conversion/process technology
BOUND(BD)Or	Bound on activity: resource technology
CAPUNIT	Units of activity/unit of capacity
CEH(Z)(Y)	Ratio of electricity lost to heat gained
CF	Annual utilisation
CF(Z)(Y)	Utilisation for season, time of day
COST	Annual resource cost
CUM	Total resource availability
DELIV(ENT)	Annual delivery cost
DELIV(MAT)	Annual delivery cost
DEMAND	End-use demand
DHDE(Z)	Distribution efficiency for low-temperature heat
DISCOUNT	Annual discount rate
EFF	Technical efficiency
ENV_ACT	Emissions coefficient/activity
ENV_BOUND(BD)	Bound on emissions
ENV_CAP	Emissions coefficient/capacity
ENV_GWP	Global Warming Potential (multiple emissions accounting)
ENV_INV	Emissions coefficient/investment
ENV_SEP	Emissions coefficient/resource activity
FIXOM	Annual fixed O&M cost
FR(Z)(Y)	Non-default fraction of demand for season, time of day
FR(Z)(Y)(ELC)	Fraction of electric import/export for season, time of day
HEATCOOL(Z)	Indicates if LTH peak equation is created for Winter/Summer
HRESERV	Reserve capacity fraction for low-temp-heat
IBOND(BD)	Bound on investment in new capacity
INP(ENC)_TID	Energy carrier initial inventory: conversion technology
INP(ENT)c	Energy carrier input: conversion technology
INP(ENT)p	Energy carrier input: process technology
INP(ENT)r	Energy carrier input: resource technology (not export)
INP(ENT)x	Energy carrier input: export resource technology
INP(MAT)_TIDp	Material input at investment time: process technology
INP(MAT)c	Material input: conversion technology
INP(MAT)p	Material input: process technology

Parameter	Description
INP(MAT)r	Material input: resource technology (not export)
INP(MAT)x	Material input: export resource technology
INVCOST	Total cost of investment in new capacity
LIFE	Lifetime of new capacity
LIMIT	Sum of energy carrier outputs
MA(ENT)	Energy carrier input: demand technology
MA(MAT)	Material input: demand technology
MA(MAT)_TID	Material input: demand technology
MO(ENC)	Energy carrier output: demand technology
OUT(DM)	End-use demand output
OUT(ELC)_TID	Electricity output
OUT(ENC)c	Energy carrier output: conversion technology
OUT(ENC)p	Energy carrier output: process technology
OUT(ENT)r	Energy carrier output: resource technology (not export)
OUT(LTH)_TID	District heat output
OUT(MAT)_TIDc	Material released upon decommissioning: conversion technology
OUT(MAT)_TIDp	Material released upon decommissioning: process technology
OUT(MAT)c	Material output: conversion technology
OUT(MAT)p	Material output: process technology
OUT(MAT)r	Material output: resource technology (not export)
PEAK(CON)	Fraction of capacity in peak equations
QHR(Z)(Y)	Fraction of year for season, time-of-day
RAT__RHS	Coefficient RHS, user-defined constraint
RAT_ACT	Coeff process activity variable, user-defined constraint
RAT_CAP	Coeff capacity variable, user-defined constraint
RAT_HPL	Coeff heating-plant activity variable, user-def constraint
RAT_INV	Coeff investment variable, user-defined constraint
RAT_SEP	Coeff resource activity variable, user-defined constraint
RAT_TCZY	Coeff coupled-prodn activity variable, user-def constraint
RAT_TEZY	Coeff electricity activity variable, user-defined constraint
REH	Ratio of electricity produced to heat produced
RESID	Residual installed capacity
SRAF(Z)	Seasonal reservoir availability
START	Start year
STARTYRS	Discount year adjuster
TE(ENT)	Transmission efficiency
TE(MAT)	Transmission efficiency: material
TRNEFF(Z)(Y)	Transmission efficiency of coupled-production technology
VAROM	Annual variable O&M cost

Table A 3. Share User-defined constraints in the transportation sector

Constraint	Description	Demand Segment	BigSet definition	Subset definition	Max/Min share
Autos (TRT)					
S_TRT_CFV	Min Share of CFV CAR in TRT	TRT*	*CAR:*	*.CFV.*	MIN
S_TRT_DST	Min Share of CFV CAR-DST in TRT	TRT*	*.CFV.*	*.DST.*	MIN
S_TRT_GSL	Min Share of CFV CAR-GAS in TRT	TRT*	*.CFV.*	*.GAS.*	MIN
S_TRT_GCC	Min Share of CFV CAR-GAS-Cafe3.5mpg in TRT	TRT*	*.CFV.GAS.*	*.CAFE.3.5MPG.*	MIN
S_TRT_GCB	Min Share of CFV CAR-GAS-Cafe7.0mpg in TRT	TRT*	*.CFV.GAS.*	*.CAFE.7.0MPG.*	MIN
S_TRT_GCA	Min Share of CFV CAR-GAS-Standard in TRT	TRT*	*.CFV.GAS.*	*.STD.*	MIN
S_TRT_AFV	Min Share of AFV CAR in TRT	TRT*	*CAR:*	*.AFV.*	MIN
S_TRT_HYB	Min Share of AFV CAR-HYB in TRT	TRT*	*.AFV.*	*.HYB.*	MIN
S_TRT_LPG	Min Share of AFV CAR-LPG in TRT	TRT*	*.AFV.*	*.LPG.*	MIN
S_TRT_ETH	Min Share of AFV CAR-ETH in TRT	TRT*	*.AFV.*	*.ETH.*	MIN
S_TRT_DEG	Min Share of AFV CAR-DEG in TRT	TRT*	*.AFV.*	*.DEG.*	MIN
S_TRT_NGA	Min Share of AFV CAR-NGA in TRT	TRT*	*.AFV.*	*.NGA.*	MIN
S_TRT_MET	Min Share of AFV CAR-MET in TRT	TRT*	*.AFV.*	*.MET.*	MIN
S_TRT_DMG	Min Share of AFV CAR-DMG in TRT	TRT*	*.AFV.*	*.DMG.*	MIN
S_TRT_ELC	Min Share of AFV CAR-ELC in TRT	TRT*	*.AFV.*	*.ELC.*	MIN
S_TRT_FUC	Min Share of AFV CAR-FUC in TRT	TRT*	*.AFV.*	*.FUC.*	MIN
Light Trucks (TRL)					
S_TRL_CFV	Min Share of CFV LIGHT TRUCK in TRL	TRL*	*LIGHT TRUCK:*	*.CFV.*	MIN
S_TRL_DST	Min Share of CFV LIGHT TRUCK-DST in TRL	TRL*	*.CFV.*	*.DST.*	MIN
S_TRL_GSL	Min Share of CFV LIGHT TRUCK-GAS in TRL	TRL*	*.CFV.*	*.GAS.*	MIN
S_TRL_GCC	Min Share of CFV LIGHT TRUCK-GAS-Cafe4mpg in TRL	TRL*	*.CFV.GAS.*	*.CAFE.4MPG.*	MIN
S_TRL_GCB	Min Share of CFV LIGHT TRUCK-GAS-Cafe2mpg in TRL	TRL*	*.CFV.GAS.*	*.CAFE.2MPG.*	MIN
S_TRL_GCA	Min Share of CFV LIGHT TRUCK-GAS-Standard in TRL	TRL*	*.CFV.GAS.*	*.STD.*	MIN
S_TRL_DCC	Min Share of CFV LIGHT TRUCK-DST-Cafe4mpg in TRL	TRL*	*.CFV.DST.*	*.CAFE.4MPG.*	MIN
S_TRL_DCB	Min Share of CFV LIGHT TRUCK-DST-Cafe2mpg in TRL	TRL*	*.CFV.DST.*	*.CAFE.2MPG.*	MIN
S_TRL_DCA	Min Share of CFV LIGHT TRUCK-DST-Standard in TRL	TRL*	*.CFV.DST.*	*.STD.*	MIN
S_TRL_AFV	Min Share of AFV LIGHT TRUCK in TRL	TRL*	*LIGHT TRUCK:*	*.AFV.*	MIN
S_TRL_NGA	Min Share of AFV LIGHT TRUCK-NGA in TRL	TRL*	*.AFV.*	*.NGA.*	MIN
S_TRL_ETH	Min Share of AFV LIGHT TRUCK-ETH in TRL	TRL*	*.AFV.*	*.ETH.*	MIN
S_TRL_DEG	Min Share of AFV LIGHT TRUCK-DEG in TRL	TRL*	*.AFV.*	*.DEG.*	MIN
S_TRL_MET	Min Share of AFV LIGHT TRUCK-MET in TRL	TRL*	*.AFV.*	*.MET.*	MIN

Constraint	Description	Demand Segment	BigSet definition	Subset definition	Max/Min share
S_TRL_DMG	Min Share of AFV LIGHT TRUCK-DMG in TRL	TRL*	*.AFV.*	*.DMG.*	MIN
S_TRL_HYB	Min Share of AFV LIGHT TRUCK-HYB in TRL	TRL*	*.AFV.*	*.HYB.*	MIN
S_TRL_LPG	Min Share of AFV LIGHT TRUCK-LPG in TRL	TRL*	*.AFV.*	*.LPG.*	MIN
S_TRL_ELC	Min Share of AFV LIGHT TRUCK-ELC in TRL	TRL*	*.AFV.*	*.ELC.*	MIN
S_TRL_FUE	Min Share of AFV LIGHT TRUCK-FUE in TRL	TRL*	*.AFV.*	*.FUE.*	MIN
Buses (TRB)					
S_TRB_CFV	Min Share of CFV BUS in TRB	TRB*	*BUS:*	*.CFV.*	MIN
S_TRB_GSL	Min Share of CFV BUS-GAS in TRB	TRB*	*.CFV.*	*.GAS.*	MIN
S_TRB_DST	Min Share of CFV BUS-DST in TRB	TRB*	*.CFV.*	*.DST.*	MIN
S_TRB_DSS	Min Share of CFV BUS-DST-Standard in TRB	TRB*	*.CFV.DST.*	*.STD.*	MIN
S_TRB_DSA	Min Share of CFV BUS-DST-10%mpg in TRB	TRB*	*.CFV.DST.*	*.10%MPG.*	MIN
S_TRB_DSB	Min Share of CFV BUS-DST-20%mpg in TRB	TRB*	*.CFV.DST.*	*.20%MPG.*	MIN
S_TRB_GSS	Min Share of CFV BUS-GAS-Standard in TRB	TRB*	*.CFV.GAS.*	*.STD.*	MIN
S_TRB_GSA	Min Share of CFV BUS-GAS-10%mpg in TRB	TRB*	*.CFV.GAS.*	*.10%MPG.*	MIN
S_TRB_GSB	Min Share of CFV BUS-GAS-20%mpg in TRB	TRB*	*.CFV.GAS.*	*.20%MPG.*	MIN
S_TRB_AFV	Min Share of AFV BUS in TRB	TRB*	*BUS:*	*.AFV.*	MIN
S_TRB_NGA	Min Share of AFV BUS-NGA in TRB	TRB*	*.AFV.*	*.NGA.*	MIN
S_TRB_LPG	Min Share of AFV BUS-LPG in TRB	TRB*	*.AFV.*	*.LPG.*	MIN
S_TRB_MET	Min Share of AFV BUS-MET in TRB	TRB*	*.AFV.*	*.MET.*	MIN
S_TRB_ETH	Min Share of AFV BUS-ETH in TRB	TRB*	*.AFV.*	*.ETH.*	MIN
S_TRB_ELC	Min Share of AFV BUS-ELC in TRB	TRB*	*.AFV.*	*.ELC.*	MIN
Medium Trucks (TRM)					
S_TRM_CFV	Min Share of CFV MEDIUM TRUCK in TRM	TRM*	*MEDIUM TRUCK:*	*.CFV.*	MIN
S_TRM_GSL	Min Share of CFV MEDIUM TRUCK-GAS in TRM	TRM*	*.CFV.*	*.GAS.*	MIN
S_TRM_DST	Min Share of CFV MEDIUM TRUCK-DST in TRM	TRM*	*.CFV.*	*.DST.*	MIN
S_TRM_AFV	Min Share of AFV MEDIUM TRUCK in TRM	TRM*	*MEDIUM TRUCK:*	*.AFV.*	MIN
S_TRM_NGA	Min Share of AFV MEDIUM TRUCK-NGA in TRM	TRM*	*.AFV.*	*.NGA.*	MIN
S_TRM_LPG	Min Share of AFV MEDIUM TRUCK-LPG in TRM	TRM*	*.AFV.*	*.LPG.*	MIN
S_TRM_MET	Min Share of AFV MEDIUM TRUCK-MET in TRM	TRM*	*.AFV.*	*.MET.*	MIN
S_TRM_ETH	Min Share of AFV MEDIUM TRUCK-ETH in TRM	TRM*	*.AFV.*	*.ETH.*	MIN
Heavy Trucks (TRH)					
S_TRH_CFV	Min Share of CFV HEAVY TRUCK in TRH	TRH*	*HEAVY TRUCK:*	*.CFV.*	MIN
S_TRH_GSL	Min Share of CFV HEAVY TRUCK-GAS in TRH	TRH*	*.CFV.*	*.GAS.*	MIN

Constraint	Description	Demand Segment	BigSet definition	Subset definition	Max/Min share
S_TRH_DST	Min Share of CFV HEAVY TRUCK-DST in TRH	TRH*	*.CFV.*	*.DST.*	MIN
S_TRH_DSS	Min Share of CFV HEAVY TRUCK-DST-Standard in TRH	TRH*	*.CFV.DST.*	*.STD.*	MIN
S_TRH_DSA	Min Share of CFV HEAVY TRUCK-DST-10%mpg in TRH	TRH*	*.CFV.DST.*	*.10%MPG.*	MIN
S_TRH_DSB	Min Share of CFV HEAVY TRUCK-DST-20%mpg in TRH	TRH*	*.CFV.DST.*	*.15%MPG.*	MIN
S_TRH_AFV	Min Share of AFV HEAVY TRUCK in TRH	TRH*	*HEAVY TRUCK:*	*.AFV.*	MIN
S_TRH_NGA	Min Share of AFV HEAVY TRUCK-NGA in TRH	TRH*	*.AFV.*	*.NGA.*	MIN
S_TRH_LPG	Min Share of AFV HEAVY TRUCK-LPG in TRH	TRH*	*.AFV.*	*.LPG.*	MIN
S_TRH_MET	Min Share of AFV HEAVY TRUCK-MET in TRH	TRH*	*.AFV.*	*.MET.*	MIN
S_TRH_ETH	Min Share of AFV HEAVY TRUCK-ETH in TRH	TRH*	*.AFV.*	*.ETH.*	MIN
Commercial Trucks (TRC)					
S_TRC_CFV	Min Share of CFV COMMERCIAL TRUCK in TRC	TRC*	*COMMERCIAL TRUCK:*	*.CFV.*	MIN
S_TRC_GSL	Min Share of CFV COMMERCIAL TRUCK-GAS in TRC	TRC*	*.CFV.*	*.GAS.*	MIN
S_TRC_DST	Min Share of CFV COMMERCIAL TRUCK-DST in TRC	TRC*	*.CFV.*	*.DST.*	MIN
S_TRC_AFV	Min Share of AFV COMMERCIAL TRUCK in TRC	TRC*	*COMMERCIAL TRUCK:*	*.AFV.*	MIN
S_TRC_NGA	Min Share of AFV COMMERCIAL TRUCK-NGA in TRC	TRC*	*.AFV.*	*.NGA.*	MIN
S_TRC_LPG	Min Share of AFV COMMERCIAL TRUCK-LPG in TRC	TRC*	*.AFV.*	*.LPG.*	MIN
S_TRC_MET	Min Share of AFV COMMERCIAL TRUCK-MET in TRC	TRC*	*.AFV.*	*.MET.*	MIN
S_TRC_ETH	Min Share of AFV COMMERCIAL TRUCK-ETH in TRC	TRC*	*.AFV.*	*.ETH.*	MIN
Two wheelers (TRW)					
S_TRW_MCG	Min Share of MOTOR CYCLE in TRW	TRW*	*MOTOR CYCLE:*	*.MCG.*	MIN
S_TRW_MPG	Min Share of MOTOR PED in TRW	TRW*	*MOTOR PED:*	*.MPG.*	MIN
Three wheelers (TRE)					
S_TRE_GSL	Min Share of THREE WHEELS-GSL in TRW	TRE*	*THREE WHEELS:*	*.GSL.*	MIN
S_TRE_DST	Min Share of THREE WHEELS-DST in TRW	TRE*	*THREE WHEELS:*	*.GSL.*	MIN

Table A 4. Minimum share User-defined constraints in the residential and the commercial sectors

Constraint	Description	Demand Segment	BigSet definition	Subset definition	Max/Min share
Commercial Cooling					
S_CC1_ELC	Min Share of ELC in CC1	CC1*	*COM.COOL.R1:*	*.ELC.*	MIN
S_CC1_NGA	Min Share of NGA in CC1	CC1*	*COM.COOL.R1:*	*.NGA.*	MIN
S_CC1_DST	Min Share of DST in CC1	CC1*	*COM.COOL.R1:*	*.DST.*	MIN
S_CC1_WAC	Min Share of ELC-ROOM in CC1	CC1*	*.ELC.*	*.ROOM.*	MIN
S_CC1_CAC	Min Share of ELC-CENTRAL in CC1	CC1*	*.ELC.*	*.CENTRAL.*	MIN
S_CC1_EHP	Min Share of ELC-HEATPUMP in CC1	CC1*	*.ELC.*	*.HEAT PUMP.*	MIN
S_CC1_ECH	Min Share of ELC-CHILLER in CC1	CC1*	*.ELC.*	*.CHILLER.*	MIN
S_CC1_ELA	Min Share of ELC-HEAT PUMP-Standard in CC1	CC1*	*.ELC.HEAT PUMP.*	*.STD.*	MIN
S_CC1_ELB	Min Share of ELC-HEAT PUMP-Improved in CC1	CC1*	*.ELC.HEAT PUMP.*	*.IMP.*	MIN
S_CC1_ELF	Min Share of ELC-CHILLER-Rooftop in CC1	CC1*	*.ELC.CHILLER.*	*.ROOFTOP.*	MIN
S_CC1_ELG	Min Share of ELC-CHILLER-Reciprocating in CC1	CC1*	*.ELC.CHILLER.*	*.RECIPROCATING.*	MIN
S_CC1_ELI	Min Share of ELC-CHILLER-Centrifugal in CC1	CC1*	*.ELC.CHILLER.*	*.CENTRIFUGAL.*	MIN
S_CC2_ELC	Min Share of ELC in CC2	CC2*	*COM.COOL.R2:*	*.ELC.*	MIN
S_CC2_NGA	Min Share of NGA in CC2	CC2*	*COM.COOL.R2:*	*.NGA.*	MIN
S_CC2_DST	Min Share of DST in CC2	CC2*	*COM.COOL.R2:*	*.DST.*	MIN
S_CC2_WAC	Min Share of ELC-ROOM in CC2	CC2*	*.ELC.*	*.ROOM.*	MIN
S_CC2_CAC	Min Share of ELC-CENTRAL in CC2	CC2*	*.ELC.*	*.CENTRAL.*	MIN
S_CC2_EHP	Min Share of ELC-HEAT PUMP in CC2	CC2*	*.ELC.*	*.HEAT PUMP.*	MIN
S_CC2_ECH	Min Share of ELC-CHILLER in CC2	CC2*	*.ELC.*	*.CHILLER.*	MIN
S_CC2_ELA	Min Share of ELC-HEAT PUMP-Standard in CC2	CC2*	*.ELC.HEAT PUMP.*	*.STD.*	MIN
S_CC2_ELB	Min Share of ELC-HEAT PUMP-Improved in CC2	CC2*	*.ELC.HEAT PUMP.*	*.IMP.*	MIN
S_CC2_ELF	Min Share of ELC-CHILLER-Rooftop in CC2	CC2*	*.ELC.CHILLER.*	*.ROOFTOP.*	MIN
S_CC2_ELG	Min Share of ELC-CHILLER-Reciprocating in CC2	CC2*	*.ELC.CHILLER.*	*.RECIPROCATING.*	MIN
S_CC2_ELI	Min Share of ELC-CHILLER-Centrifugal in CC2	CC2*	*.ELC.CHILLER.*	*.CENTRIFUGAL.*	MIN
S_CC3_ELC	Min Share of ELC in CC3	CC3*	*COM.COOL.R3:*	*.ELC.*	MIN
S_CC3_NGA	Min Share of NGA in CC3	CC3*	*COM.COOL.R3:*	*.NGA.*	MIN
S_CC3_DST	Min Share of DST in CC3	CC3*	*COM.COOL.R3:*	*.DST.*	MIN
S_CC3_WAC	Min Share of ELC-ROOM in CC3	CC3*	*.ELC.*	*.ROOM.*	MIN
S_CC3_CAC	Min Share of ELC-CENTRAL in CC3	CC3*	*.ELC.*	*.CENTRAL.*	MIN
S_CC3_EHP	Min Share of ELC-HEAT PUMP in CC3	CC3*	*.ELC.*	*.HEAT PUMP.*	MIN
S_CC3_ECH	Min Share of ELC-CHILLER in CC3	CC3*	*.ELC.*	*.CHILLER.*	MIN

Constraint	Description	Demand Segment	BigSet definition	Subset definition	Max/Min share
S_CC3_ELA	Min Share of ELC-HEAT PUMP-Standard in CC3	CC3*	*.ELC.HEAT PUMP.*	*.STD.*	MIN
S_CC3_ELB	Min Share of ELC-HEAT PUMP-Improved in CC3	CC3*	*.ELC.HEAT PUMP.*	*.IMP.*	MIN
S_CC3_ELF	Min Share of ELC-CHILLER-Rooftop in CC3	CC3*	*.ELC.CHILLER.*	*.ROOFTOP.*	MIN
S_CC3_ELG	Min Share of ELC-CHILLER-Reciprocating in CC3	CC3*	*.ELC.CHILLER.*	*.RECIPROCATING.*	MIN
S_CC3_ELI	Min Share of ELC-CHILLER-Centrifugal in CC3	CC3*	*.ELC.CHILLER.*	*.CENTRIFUGAL.*	MIN
S_CC4_ELC	Min Share of ELC in CC4	CC4*	*COM.COOL.R4:*	*.ELC.*	MIN
S_CC4_NGA	Min Share of NGA in CC4	CC4*	*COM.COOL.R4:*	*.NGA.*	MIN
S_CC4_DST	Min Share of DST in CC4	CC4*	*COM.COOL.R4:*	*.DST.*	MIN
S_CC4_WAC	Min Share of ELC-ROOM in CC4	CC4*	*.ELC.*	*.ROOM.*	MIN
S_CC4_CAC	Min Share of ELC-CENTRAL in CC4	CC4*	*.ELC.*	*.CENTRAL.*	MIN
S_CC4_EHP	Min Share of ELC-HEAT PUMP in CC4	CC4*	*.ELC.*	*.HEAT PUMP.*	MIN
S_CC4_ECH	Min Share of ELC-CHILLER in CC4	CC4*	*.ELC.*	*.CHILLER.*	MIN
S_CC4_ELA	Min Share of ELC-HEAT PUMP-Standard in CC4	CC4*	*.ELC.HEAT PUMP.*	*.STD.*	MIN
S_CC4_ELB	Min Share of ELC-HEAT PUMP-Improved in CC4	CC4*	*.ELC.HEAT PUMP.*	*.IMP.*	MIN
S_CC4_ELF	Min Share of ELC-CHILLER-Rooftop in CC4	CC4*	*.ELC.CHILLER.*	*.ROOFTOP.*	MIN
S_CC4_ELG	Min Share of ELC-CHILLER-Reciprocating in CC4	CC4*	*.ELC.CHILLER.*	*.RECIPROCATING.*	MIN
S_CC4_ELI	Min Share of ELC-CHILLER-Centrifugal in CC4	CC4*	*.ELC.CHILLER.*	*.CENTRIFUGAL.*	MIN
Commercial Heating					
S_CH1_ELC	Min Share of ELC in CH1	CH1*	*COM.HEAT.R1:*	*.ELC.*	MIN
S_CH1_NGA	Min Share of NGA in CH1	CH1*	*COM.HEAT.R1:*	*.NGA.*	MIN
S_CH1_DST	Min Share of DST in CH1	CH1*	*COM.HEAT.R1:*	*.DST.*	MIN
S_CH1_HFO	Min Share of HFO in CH1	CH1*	*COM.HEAT.R1:*	*.HFO.*	MIN
S_CH1_KER	Min Share of KER in CH1	CH1*	*COM.HEAT.R1:*	*.KER.*	MIN
S_CH1_COA	Min Share of COA in CH1	CH1*	*COM.HEAT.R1:*	*.COA.*	MIN
S_CH1_LPG	Min Share of LPG in CH1	CH1*	*COM.HEAT.R1:*	*.LPG.*	MIN
S_CH1_BIO	Min Share of BIO in CH1	CH1*	*COM.HEAT.R1:*	*.BIO.*	MIN
S_CH1_HET	Min Share of HET in CH1	CH1*	*COM.HEAT.R1:*	*.HET.*	MIN
S_CH1_GEO	Min Share of GEO in CH1	CH1*	*COM.HEAT.R1:*	*.GEO.*	MIN
S_CH1_EHP	Min Share of ELC-HEAT PUMP in CH1	CH1*	*.ELC.*	*.HEAT PUMP.*	MIN
S_CH1_ERS	Min Share of ELC-RESISTANCE in CH1	CH1*	*.ELC.*	*.RESISTANCE.*	MIN
S_CH1_NHP	Min Share of NGA-BURNER-Standard in CH1	CH1*	*.NGA.*	*.STD.*	MIN
S_CH1_NBU	Min Share of NGA-BURNER-Improved in CH1	CH1*	*.NGA.*	*.IMP.*,*.ADV.*	MIN
S_CH2_ELC	Min Share of ELC in CH2	CH2*	*COM.HEAT.R2:*	*.ELC.*	MIN

Constraint	Description	Demand Segment	BigSet definition	Subset definition	Max/Min share
S_CH2_NGA	Min Share of NGA in CH2	CH2*	*COM.HEAT.R2:*	*.NGA.*	MIN
S_CH2_DST	Min Share of DST in CH2	CH2*	*COM.HEAT.R2:*	*.DST.*	MIN
S_CH2_HFO	Min Share of HFO in CH2	CH2*	*COM.HEAT.R2:*	*.HFO.*	MIN
S_CH2_KER	Min Share of KER in CH2	CH2*	*COM.HEAT.R2:*	*.KER.*	MIN
S_CH2_COA	Min Share of COA in CH2	CH2*	*COM.HEAT.R2:*	*.COA.*	MIN
S_CH2_LPG	Min Share of LPG in CH2	CH2*	*COM.HEAT.R2:*	*.LPG.*	MIN
S_CH2_BIO	Min Share of BIO in CH2	CH2*	*COM.HEAT.R2:*	*.BIO.*	MIN
S_CH2_HET	Min Share of HET in CH2	CH2*	*COM.HEAT.R2:*	*.HET.*	MIN
S_CH2_GEO	Min Share of GEO in CH2	CH2*	*COM.HEAT.R2:*	*.GEO.*	MIN
S_CH2_EHP	Min Share of ELC-HEAT PUMP in CH2	CH2*	*.ELC.*	*.HEAT PUMP.*	MIN
S_CH2_ERS	Min Share of ELC-RESISTANCE in CH2	CH2*	*.ELC.*	*.RESISTANCE.*	MIN
S_CH2_NHP	Min Share of NGA-BURNER-Standard in CH2	CH2*	*.NGA.*	*.STD.*	MIN
S_CH2_NBU	Min Share of NGA-BURNER-Improved in CH2	CH2*	*.NGA.*	*.IMP.*,*.ADV.*	MIN
S_CH3_ELC	Min Share of ELC in CH3	CH3*	*COM.HEAT.R3:*	*.ELC.*	MIN
S_CH3_NGA	Min Share of NGA in CH3	CH3*	*COM.HEAT.R3:*	*.NGA.*	MIN
S_CH3_DST	Min Share of DST in CH3	CH3*	*COM.HEAT.R3:*	*.DST.*	MIN
S_CH3_HFO	Min Share of HFO in CH3	CH3*	*COM.HEAT.R3:*	*.HFO.*	MIN
S_CH3_KER	Min Share of KER in CH3	CH3*	*COM.HEAT.R3:*	*.KER.*	MIN
S_CH3_COA	Min Share of COA in CH3	CH3*	*COM.HEAT.R3:*	*.COA.*	MIN
S_CH3_LPG	Min Share of LPG in CH3	CH3*	*COM.HEAT.R3:*	*.LPG.*	MIN
S_CH3_BIO	Min Share of BIO in CH3	CH3*	*COM.HEAT.R3:*	*.BIO.*	MIN
S_CH3_HET	Min Share of HET in CH3	CH3*	*COM.HEAT.R3:*	*.HET.*	MIN
S_CH3_GEO	Min Share of GEO in CH3	CH3*	*COM.HEAT.R3:*	*.GEO.*	MIN
S_CH3_EHP	Min Share of ELC-HEAT PUMP in CH3	CH3*	*.ELC.*	*.HEAT PUMP.*	MIN
S_CH3_ERS	Min Share of ELC-RESISTANCE in CH3	CH3*	*.ELC.*	*.RESISTANCE.*	MIN
S_CH3_NHP	Min Share of NGA-BURNER-Standard in CH3	CH3*	*.NGA.*	*.STD.*	MIN
S_CH3_NBU	Min Share of NGA-BURNER-Improved in CH3	CH3*	*.NGA.*	*.IMP.*,*.ADV.*	MIN
S_CH4_ELC	Min Share of ELC in CH4	CH4*	*COM.HEAT.R4:*	*.ELC.*	MIN
S_CH4_NGA	Min Share of NGA in CH4	CH4*	*COM.HEAT.R4:*	*.NGA.*	MIN
S_CH4_DST	Min Share of DST in CH4	CH4*	*COM.HEAT.R4:*	*.DST.*	MIN
S_CH4_HFO	Min Share of HFO in CH4	CH4*	*COM.HEAT.R4:*	*.HFO.*	MIN
S_CH4_KER	Min Share of KER in CH4	CH4*	*COM.HEAT.R4:*	*.KER.*	MIN
S_CH4_COA	Min Share of COA in CH4	CH4*	*COM.HEAT.R4:*	*.COA.*	MIN

Constraint	Description	Demand Segment	BigSet definition	Subset definition	Max/Min share
S_CH4_LPG	Min Share of LPG in CH4	CH4*	*COM.HEAT.R4:*	*.LPG.*	MIN
S_CH4_BIO	Min Share of BIO in CH4	CH4*	*COM.HEAT.R4:*	*.BIO.*	MIN
S_CH4_HET	Min Share of HET in CH4	CH4*	*COM.HEAT.R4:*	*.HET.*	MIN
S_CH4_GEO	Min Share of GEO in CH4	CH4*	*COM.HEAT.R4:*	*.GEO.*	MIN
S_CH4_EHP	Min Share of ELC-HEAT PUMP in CH4	CH4*	*.ELC.*	*.HEAT PUMP.*	MIN
S_CH4_ERS	Min Share of ELC-RESISTANCE in CH4	CH4*	*.ELC.*	*.RESISTANCE.*	MIN
S_CH4_NHP	Min Share of NGA-BURNER-Standard in CH4	CH4*	*.NGA.*	*.STD.*	MIN
S_CH4_NBU	Min Share of NGA-BURNER-Improved in CH4	CH4*	*.NGA.*	*.IMP.*,*.ADV.*	MIN
Commercial Hot Water					
S_CHW_ELC	Min Share of ELC in CHW	CHW*	*.WATER HEATER.*	*.ELC.*	MIN
S_CHW_NGA	Min Share of NGA in CHW	CHW*	*.WATER HEATER.*	*.NGA.*	MIN
S_CHW_DST	Min Share of DST in CHW	CHW*	*.WATER HEATER.*	*.DST.*	MIN
S_CHW_HFO	Min Share of HFO in CHW	CHW*	*.WATER HEATER.*	*.HFO.*	MIN
S_CHW_KER	Min Share of KER in CHW	CHW*	*.WATER HEATER.*	*.KER.*	MIN
S_CHW_COA	Min Share of COA in CHW	CHW*	*.WATER HEATER.*	*.COA.*	MIN
S_CHW_LPG	Min Share of LPG in CHW	CHW*	*.WATER HEATER.*	*.LPG.*	MIN
S_CHW_SOL	Min Share of SOL in CHW	CHW*	*.WATER HEATER.*	*.SOL.*	MIN
S_CHW_ELH	Min Share of ELC-HEAT PUMP in CHW	CHW*	*.ELC.*	*.HEAT PUMP.*	MIN
S_CHW_ELR	Min Share of ELC-RESISTANCE in CHW	CHW*	*.ELC.*	*.RESISTANCE.*	MIN
S_CHW_NGS	Min Share of NGA-Standard in CHW	CHW*	*.NGA.*	*.STD.*	MIN
S_CHW_NGI	Min Share of NGA-Improved in CHW	CHW*	*.NGA.*	*.IMP.*	MIN
S_CHW_DSS	Min Share of DST-Standard in CHW	CHW*	*.DST.*	*.STD.*	MIN
S_CHW_DSI	Min Share of DST-Improved in CHW	CHW*	*.DST.*	*.IMP.*	MIN
Commercial Lighting					
S_CLA_KER	Min Share of KER in CLA	CLA*	*COM.LIGH:*	*.KER.*	MIN
S_CLA_ELC	Min Share of ELC in CLA	CLA*	*COM.LIGH:*	*.ELC.*	MIN
S_CLA_FLU	Min Share of ELC-FLUORESCENT in CLA	CLA*	*.ELC.*	*.FLUORESCENT.*	MIN
S_CLA_CFL	Min Share of ELC-FLUO in CLA	CLA*	*.ELC.*	*.FLUO.*	MIN
S_CLA_HID	Min Share of ELC-MERCURY/SULFER in CLA	CLA*	*.ELC.*	*.MERCURY.*,*.SULFER.*	MIN
S_CLA_ICE	Min Share of ELC-INCANDESCENT in CLA	CLA*	*.ELC.*	*.INCANDESCENT.*	MIN
S_CLA_HAE	Min Share of ELC-HALOGEN in CLA	CLA*	*.ELC.*	*.HALOGEN.*	MIN
S_CLA_SEF	Min Share of ELC-FLUORESCENT-Baseline in CLA	CLA*	*.FLUORESCENT.*	*.BASELINE.*	MIN
S_CLA_MEF	Min Share of ELC-FLUORESCENT-Rapidstart in CLA	CLA*	*.FLUORESCENT.*	*.RAPIDSTART.*	MIN

Constraint	Description	Demand Segment	BigSet definition	Subset definition	Max/Min share
S_CLA_HEF	Min Share of ELC-FLUORESCENT-Electrodeless in CLA	CLA*	*.FLUORESCENT.*	*.ELECTRODELESS.*	MIN
Commercial Cooking					
S_CCK_ELC	Min Share of ELC in CCK	CCK*	*.COOKING.*	*.ELC.*	MIN
S_CCK_NGA	Min Share of NGA in CCK	CCK*	*.COOKING.*	*.NGA.*	MIN
S_CCK_KER	Min Share of KER in CCK	CCK*	*.COOKING.*	*.KER.*	MIN
S_CCK_COA	Min Share of COA in CCK	CCK*	*.COOKING.*	*.COA.*	MIN
S_CCK_LPG	Min Share of LPG in CCK	CCK*	*.COOKING.*	*.LPG.*	MIN
S_CCK_BIO	Min Share of BIO in CCK	CCK*	*.COOKING.*	*.BIO.*	MIN
Residential Lighting					
S_RL1_KER	Min Share of KER in RL1	RL1*	*RES.LIGH.R1:*	*.KER.*	MIN
S_RL1_ELC	Min Share of ELC in RL1	RL1*	*RES.LIGH.R1:*	*.ELC.*	MIN
S_RL1_FLU	Min Share of ELC-FLUORESCENT in RL1	RL1*	*.ELC.*	*.FLUORESCENT.*	MIN
S_RL1_CFL	Min Share of ELC-FLUO in RL1	RL1*	*.ELC.*	*.FLUO.*	MIN
S_RL1_ICE	Min Share of ELC-INCANDESCENT in RL1	RL1*	*.ELC.*	*.INCANDESCENT.*	MIN
S_RL1_HAE	Min Share of ELC-HALOGEN in RL1	RL1*	*.ELC.*	*.HALOGEN.*	MIN
S_RL1_SEF	Min Share of ELC-FLUORESCENT-Baseline in RL1	RL1*	*.ELC.FLUORESCENT.*	*.BASELINE.*	MIN
S_RL1_MEF	Min Share of ELC-FLUORESCENT-Rapidstart in RL1	RL1*	*.ELC.FLUORESCENT.*	*.RAPIDSTART.*	MIN
S_RL2_KER	Min Share of KER in RL2	RL2*	*RES.LIGH.R2:*	*.KER.*	MIN
S_RL2_ELC	Min Share of ELC in RL2	RL2*	*RES.LIGH.R2:*	*.ELC.*	MIN
S_RL2_FLU	Min Share of ELC-FLUORESCENT in RL2	RL2*	*.ELC.*	*.FLUORESCENT.*	MIN
S_RL2_CFL	Min Share of ELC-FLUO in RL2	RL2*	*.ELC.*	*.FLUO.*	MIN
S_RL2_ICE	Min Share of ELC-INCANDESCENT in RL2	RL2*	*.ELC.*	*.INCANDESCENT.*	MIN
S_RL2_HAE	Min Share of ELC-HALOGEN in RL2	RL2*	*.ELC.*	*.HALOGEN.*	MIN
S_RL2_SEF	Min Share of ELC-FLUORESCENT-Baseline in RL2	RL2*	*.FLUORESCENT.*	*.BASELINE.*	MIN
S_RL2_MEF	Min Share of ELC-FLUORESCENT-Rapidstart in RL2	RL2*	*.FLUORESCENT.*	*.RAPIDSTART.*	MIN
S_RL3_KER	Min Share of KER in RL3	RL3*	*RES.LIGH.R3:*	*.KER.*	MIN
S_RL3_ELC	Min Share of ELC in RL3	RL3*	*RES.LIGH.R3:*	*.ELC.*	MIN
S_RL3_FLU	Min Share of ELC-FLUORESCENT in RL3	RL3*	*.ELC.*	*.FLUORESCENT.*	MIN
S_RL3_CFL	Min Share of ELC-FLUO in RL3	RL3*	*.ELC.*	*.FLUO.*	MIN
S_RL3_ICE	Min Share of ELC-INCANDESCENT in RL3	RL3*	*.ELC.*	*.INCANDESCENT.*	MIN
S_RL3_HAE	Min Share of ELC-HALOGEN in RL3	RL3*	*.ELC.*	*.HALOGEN.*	MIN
S_RL3_SEF	Min Share of ELC-FLUORESCENT-Baseline in RL3	RL3*	*.FLUORESCENT.*	*.BASELINE.*	MIN
S_RL3_MEF	Min Share of ELC-FLUORESCENT-Rapidstart in RL3	RL3*	*.FLUORESCENT.*	*.RAPIDSTART.*	MIN

Constraint	Description	Demand Segment	BigSet definition	Subset definition	Max/Min share
S_RL4_KER	Min Share of KER in RL4	RL4*	*RES.LIGH.R4:*	*.KER.*	MIN
S_RL4_ELC	Min Share of ELC in RL4	RL4*	*RES.LIGH.R4:*	*.ELC.*	MIN
S_RL4_FLU	Min Share of ELC-FLUORESCENT in RL4	RL4*	*.ELC.*	*.FLUORESCENT.*	MIN
S_RL4_CFL	Min Share of ELC-FLUO in RL4	RL4*	*.ELC.*	*.FLUO.*	MIN
S_RL4_ICE	Min Share of ELC-INCANDESCENT in RL4	RL4*	*.ELC.*	*.INCANDESCENT.*	MIN
S_RL4_HAE	Min Share of ELC-HALOGEN in RL4	RL4*	*.ELC.*	*.HALOGEN.*	MIN
S_RL4_SEF	Min Share of ELC-FLUORESCENT-Baseline in RL4	RL4*	*.FLUORESCENT.*	*.BASELINE.*	MIN
S_RL4_MEF	Min Share of ELC-FLUORESCENT-Rapidstart in RL4	RL4*	*.FLUORESCENT.*	*.RAPIDSTART.*	MIN
Residential Cooling					
S_RC1_ELC	Min Share of ELC in RC1	RC1*	*RES.COOL.R1:*	*.ELC.*	MIN
S_RC1_NGA	Min Share of NGA in RC1	RC1*	*RES.COOL.R1:*	*.NGA.*	MIN
S_RC1_DST	Min Share of DST in RC1	RC1*	*RES.COOL.R1:*	*.DST.*	MIN
S_RC1_WAC	Min Share of ELC-ROOM in RC1	RC1*	*.ELC.*	*.ROOM.*	MIN
S_RC1_CAC	Min Share of ELC-CENTRAL in RC1	RC1*	*.ELC.*	*.CENTRAL.*	MIN
S_RC1_EHP	Min Share of ELC-HEAT PUMP in RC1	RC1*	*.ELC.*	*.HEAT PUMP.*	MIN
S_RC1_ERS	Min Share of ELC-ROOM-Standard in RC1	RC1*	*.ELC.INS-___.ROOM.*	*.STD.*	MIN
S_RC1_ERN	Min Share of ELC-ROOM-New in RC1	RC1*	*.ELC.INS-___.ROOM.*	*.NEW.*	MIN
S_RC1_EHS	Min Share of ELC-HEAT PUMP-Standard in RC1	RC1*	*.ELC.INS-___.HEAT PUMP.*	*.STD.*	MIN
S_RC1_EHN	Min Share of ELC-HEAT PUMP-Improved in RC1	RC1*	*.ELC.INS-___.HEAT PUMP.*	*.IMP.*	MIN
S_RC1_EHA	Min Share of ELC-HEAT PUMP-Advanced in RC1	RC1*	*.ELC.INS-___.HEAT PUMP.*	*.ADV.*	MIN
S_RC2_ELC	Min Share of ELC in RC2	RC2*	*RES.COOL.R2:*	*.ELC.*	MIN
S_RC2_NGA	Min Share of NGA in RC2	RC2*	*RES.COOL.R2:*	*.NGA.*	MIN
S_RC2_DST	Min Share of DST in RC2	RC2*	*RES.COOL.R2:*	*.DST.*	MIN
S_RC2_WAC	Min Share of ELC-ROOM in RC2	RC2*	*.ELC.*	*.ROOM.*	MIN
S_RC2_CAC	Min Share of ELC-CENTRAL in RC2	RC2*	*.ELC.*	*.CENTRAL.*	MIN
S_RC2_EHP	Min Share of ELC-HEAT PUMP in RC2	RC2*	*.ELC.*	*.HEAT PUMP.*	MIN
S_RC2_ERS	Min Share of ELC-ROOM-Standard in RC2	RC2*	*.ELC.INS-___.ROOM.*	*.STD.*	MIN
S_RC2_ERN	Min Share of ELC-ROOM-New in RC2	RC2*	*.ELC.INS-___.ROOM.*	*.NEW.*	MIN
S_RC2_EHS	Min Share of ELC-HEAT PUMP-Standard in RC2	RC2*	*.ELC.INS-___.HEAT PUMP.*	*.STD.*	MIN
S_RC2_EHN	Min Share of ELC-HEAT PUMP-Improved in RC2	RC2*	*.ELC.INS-___.HEAT PUMP.*	*.IMP.*	MIN
S_RC2_EHA	Min Share of ELC-HEAT PUMP-Advanced in RC2	RC2*	*.ELC.INS-___.HEAT PUMP.*	*.ADV.*	MIN

Constraint	Description	Demand Segment	BigSet definition	Subset definition	Max/Min share
S_RC3_ELC	Min Share of ELC in RC3	RC3*	*RES.COOL.R3:*	*.ELC.*	MIN
S_RC3_NGA	Min Share of NGA in RC3	RC3*	*RES.COOL.R3:*	*.NGA.*	MIN
S_RC3_DST	Min Share of DST in RC3	RC3*	*RES.COOL.R3:*	*.DST.*	MIN
S_RC3_WAC	Min Share of ELC-ROOM in RC3	RC3*	*.ELC.*	*.ROOM.*	MIN
S_RC3_CAC	Min Share of ELC-CENTRAL in RC3	RC3*	*.ELC.*	*.CENTRAL.*	MIN
S_RC3_EHP	Min Share of ELC-HEAT PUMP in RC3	RC3*	*.ELC.*	*.HEAT PUMP.*	MIN
S_RC3_ERS	Min Share of ELC-ROOM-Standard in RC3	RC3*	*.ELC.INS-___.ROOM.*	*.STD.*	MIN
S_RC3_ERN	Min Share of ELC-ROOM-New in RC3	RC3*	*.ELC.INS-___.ROOM.*	*.NEW.*	MIN
S_RC3_EHS	Min Share of ELC-HEAT PUMP-Standard in RC3	RC3*	*.ELC.INS-___.HEAT PUMP.*	*.STD.*	MIN
S_RC3_EHN	Min Share of ELC-HEAT PUMP-Improved in RC3	RC3*	*.ELC.INS-___.HEAT PUMP.*	*.IMP.*	MIN
S_RC3_EHA	Min Share of ELC-HEAT PUMP-Advanced in RC3	RC3*	*.ELC.INS-___.HEAT PUMP.*	*.ADV.*	MIN
S_RC4_ELC	Min Share of ELC in RC4	RC4*	*RES.COOL.R4:*	*.ELC.*	MIN
S_RC4_NGA	Min Share of NGA in RC4	RC4*	*RES.COOL.R4:*	*.NGA.*	MIN
S_RC4_DST	Min Share of DST in RC4	RC4*	*RES.COOL.R4:*	*.DST.*	MIN
S_RC4_WAC	Min Share of ELC-ROOM in RC4	RC4*	*.ELC.*	*.ROOM.*	MIN
S_RC4_CAC	Min Share of ELC-CENTRAL in RC4	RC4*	*.ELC.*	*.CENTRAL.*	MIN
S_RC4_EHP	Min Share of ELC-HEAT PUMP in RC4	RC4*	*.ELC.*	*.HEAT PUMP.*	MIN
S_RC4_ERS	Min Share of ELC-ROOM-Standard in RC4	RC4*	*.ELC.INS-___.ROOM.*	*.STD.*	MIN
S_RC4_ERN	Min Share of ELC-ROOM-New in RC4	RC4*	*.ELC.INS-___.ROOM.*	*.NEW.*	MIN
S_RC4_EHS	Min Share of ELC-HEAT PUMP-Standard in RC4	RC4*	*.ELC.INS-___.HEAT PUMP.*	*.STD.*	MIN
S_RC4_EHN	Min Share of ELC-HEAT PUMP-Improved in RC4	RC4*	*.ELC.INS-___.HEAT PUMP.*	*.IMP.*	MIN
S_RC4_EHA	Min Share of ELC-HEAT PUMP-Advanced in RC4	RC4*	*.ELC.INS-___.HEAT PUMP.*	*.ADV.*	MIN
Residential Heating					
S_RH1_ELC	Min Share of ELC in RH1	RH1*	*RES.HEAT.R1:*	*.ELC.*	MIN
S_RH1_NGA	Min Share of NGA in RH1	RH1*	*RES.HEAT.R1:*	*.NGA.*	MIN
S_RH1_DST	Min Share of DST in RH1	RH1*	*RES.HEAT.R1:*	*.DST.*	MIN
S_RH1_HFO	Min Share of HFO in RH1	RH1*	*RES.HEAT.R1:*	*.HFO.*	MIN
S_RH1_KER	Min Share of KER in RH1	RH1*	*RES.HEAT.R1:*	*.KER.*	MIN
S_RH1_COA	Min Share of COA in RH1	RH1*	*RES.HEAT.R1:*	*.COA.*	MIN
S_RH1_LPG	Min Share of LPG in RH1	RH1*	*RES.HEAT.R1:*	*.LPG.*	MIN
S_RH1_BIO	Min Share of BIO in RH1	RH1*	*RES.HEAT.R1:*	*.BIO.*	MIN

Constraint	Description	Demand Segment	BigSet definition	Subset definition	Max/Min share
S_RH1_HET	Min Share of HET in RH1	RH1*	*RES.HEAT.R1:*	*.HET.*	MIN
S_RH1_GEO	Min Share of GEO in RH1	RH1*	*RES.HEAT.R1:*	*.GEO.*	MIN
S_RH1_EHP	Min Share of ELC-HEAT PUMP in RH1	RH1*	*.ELC.*	*.HEAT PUMP.*	MIN
S_RH1_ERS	Min Share of ELC-RESISTANCE in RH1	RH1*	*.ELC.*	*.RESISTANCE.*	MIN
S_RH1_NHP	Min Share of NGA-HEAT PUMP in RH1	RH1*	*.NGA.*	*.HEAT PUMP.*	MIN
S_RH1_NBU	Min Share of NGA-BURNER in RH1	RH1*	*.NGA.*	*.BURNER.*	MIN
S_RH1_EHS	Min Share of ELC-HEAT PUMP-Standard in RH1	RH1*	*.ELC.INS-___.HEAT PUMP.*	*.STD.*	MIN
S_RH1_EHI	Min Share of ELC-HEAT PUMP-Improved in RH1	RH1*	*.ELC.INS-___.HEAT PUMP.*	*.IMP.*	MIN
S_RH1_EHA	Min Share of ELC-HEAT PUMP-Advanced in RH1	RH1*	*.ELC.INS-___.HEAT PUMP.*	*.ADV.*	MIN
S_RH1_EBS	Min Share of NGA-BURNER-Standard in RH1	RH1*	*.NGA.INS-___.BURNER.*	*.STD.*	MIN
S_RH1_EBI	Min Share of NGA-BURNER-Improved in RH1	RH1*	*.NGA.INS-___.BURNER.*	*.IMP.*	MIN
S_RH1_EBN	Min Share of NGA-BURNER-New in RH1	RH1*	*.NGA.INS-___.BURNER.*	*.NEW.*	MIN
S_RH1_NHS	Min Share of NGA-HEAT PUMP-Standard in RH1	RH1*	*.NGA.INS-___.HEAT PUMP.*	*.STD.*	MIN
S_RH1_NHH	Min Share of NGA-HEAT PUMP-Hicool in RH1	RH1*	*.NGA.INS-___.HEAT PUMP.*	*.HICOOL.*	MIN
S_RH2_ELC	Min Share of ELC in RH2	RH2*	*RES.HEAT.R2:*	*.ELC.*	MIN
S_RH2_NGA	Min Share of NGA in RH2	RH2*	*RES.HEAT.R2:*	*.NGA.*	MIN
S_RH2_DST	Min Share of DST in RH2	RH2*	*RES.HEAT.R2:*	*.DST.*	MIN
S_RH2_HFO	Min Share of HFO in RH2	RH2*	*RES.HEAT.R2:*	*.HFO.*	MIN
S_RH2_KER	Min Share of KER in RH2	RH2*	*RES.HEAT.R2:*	*.KER.*	MIN
S_RH2_COA	Min Share of COA in RH2	RH2*	*RES.HEAT.R2:*	*.COA.*	MIN
S_RH2_LPG	Min Share of LPG in RH2	RH2*	*RES.HEAT.R2:*	*.LPG.*	MIN
S_RH2_BIO	Min Share of BIO in RH2	RH2*	*RES.HEAT.R2:*	*.BIO.*	MIN
S_RH2_HET	Min Share of HET in RH2	RH2*	*RES.HEAT.R2:*	*.HET.*	MIN
S_RH2_GEO	Min Share of GEO in RH2	RH2*	*RES.HEAT.R2:*	*.GEO.*	MIN
S_RH2_EHP	Min Share of ELC-HEAT PUMP in RH2	RH2*	*.ELC.*	*.HEAT PUMP.*	MIN
S_RH2_ERS	Min Share of ELC-RESISTANCE in RH2	RH2*	*.ELC.*	*.RESISTANCE.*	MIN
S_RH2_NHP	Min Share of NGA-HEAT PUMP in RH2	RH2*	*.NGA.*	*.HEAT PUMP.*	MIN
S_RH2_NBU	Min Share of NGA-BURNER in RH2	RH2*	*.NGA.*	*.BURNER.*	MIN
S_RH2_EHS	Min Share of ELC-HEAT PUMP-Standard in RH2	RH2*	*.ELC.INS-___.HEAT PUMP.*	*.STD.*	MIN
S_RH2_EHI	Min Share of ELC-HEAT PUMP-Improved in RH2	RH2*	*.ELC.INS-___.HEAT	*.IMP.*	MIN

Constraint	Description	Demand Segment	BigSet definition	Subset definition	Max/Min share
S_RH2_EHA	Min Share of ELC-HEAT PUMP-Advanced in RH2	RH2*	*.ELC.INS-___.HEAT PUMP.*	*.ADV.*	MIN
S_RH2_EBS	Min Share of NGA-BURNER-Standard in RH2	RH2*	*.NGA.INS-___.BURNER.*	*.STD.*	MIN
S_RH2_EBI	Min Share of NGA-BURNER-Improved in RH2	RH2*	*.NGA.INS-___.BURNER.*	*.IMP.*	MIN
S_RH2_EBN	Min Share of NGA-BURNER-New in RH2	RH2*	*.NGA.INS-___.BURNER.*	*.NEW.*	MIN
S_RH2_NHS	Min Share of NGA-HEAT PUMP-Standard in RH2	RH2*	*.NGA.INS-___.HEAT PUMP.*	*.STD.*	MIN
S_RH2_NHH	Min Share of NGA-HEAT PUMP-Hicool in RH2	RH2*	*.NGA.INS-___.HEAT PUMP.*	*.HICOOL.*	MIN
S_RH3_ELC	Min Share of ELC in RH3	RH3*	*RES.HEAT.R3:*	*.ELC.*	MIN
S_RH3_NGA	Min Share of NGA in RH3	RH3*	*RES.HEAT.R3:*	*.NGA.*	MIN
S_RH3_DST	Min Share of DST in RH3	RH3*	*RES.HEAT.R3:*	*.DST.*	MIN
S_RH3_HFO	Min Share of HFO in RH3	RH3*	*RES.HEAT.R3:*	*.HFO.*	MIN
S_RH3_KER	Min Share of KER in RH3	RH3*	*RES.HEAT.R3:*	*.KER.*	MIN
S_RH3_COA	Min Share of COA in RH3	RH3*	*RES.HEAT.R3:*	*.COA.*	MIN
S_RH3_LPG	Min Share of LPG in RH3	RH3*	*RES.HEAT.R3:*	*.LPG.*	MIN
S_RH3_BIO	Min Share of BIO in RH3	RH3*	*RES.HEAT.R3:*	*.BIO.*	MIN
S_RH3_HET	Min Share of HET in RH3	RH3*	*RES.HEAT.R3:*	*.HET.*	MIN
S_RH3_GEO	Min Share of GEO in RH3	RH3*	*RES.HEAT.R3:*	*.GEO.*	MIN
S_RH3_EHP	Min Share of ELC-HEAT PUMP in RH3	RH3*	*.ELC.*	*.HEAT PUMP.*	MIN
S_RH3_ERS	Min Share of ELC-RESISTANCE in RH3	RH3*	*.ELC.*	*.RESISTANCE.*	MIN
S_RH3_NHP	Min Share of NGA-HEAT PUMP in RH3	RH3*	*.NGA.*	*.HEAT PUMP.*	MIN
S_RH3_NBU	Min Share of NGA-BURNER in RH3	RH3*	*.NGA.*	*.BURNER.*	MIN
S_RH3_EHS	Min Share of ELC-HEAT PUMP-Standard in RH3	RH3*	*.ELC.INS-___.HEAT PUMP.*	*.STD.*	MIN
S_RH3_EHI	Min Share of ELC-HEAT PUMP-Improved in RH3	RH3*	*.ELC.INS-___.HEAT PUMP.*	*.IMP.*	MIN
S_RH3_EHA	Min Share of ELC-HEAT PUMP-Advanced in RH3	RH3*	*.ELC.INS-___.HEAT PUMP.*	*.ADV.*	MIN
S_RH3_EBS	Min Share of NGA-BURNER-Standard in RH3	RH3*	*.NGA.INS-___.BURNER.*	*.STD.*	MIN
S_RH3_EBI	Min Share of NGA-BURNER-Improved in RH3	RH3*	*.NGA.INS-___.BURNER.*	*.IMP.*	MIN
S_RH3_EBN	Min Share of NGA-BURNER-New in RH3	RH3*	*.NGA.INS-___.BURNER.*	*.NEW.*	MIN
S_RH3_NHS	Min Share of NGA-HEAT PUMP-Standard in RH3	RH3*	*.NGA.INS-___.HEAT PUMP.*	*.STD.*	MIN

Constraint	Description	Demand Segment	BigSet definition	Subset definition	Max/Min share
S_RH3_NHH	Min Share of NGA-HEAT PUMP-Hicool in RH3	RH3*	*.NGA.INS-___.HEAT PUMP.*	*.HICOOL.*	MIN
S_RH4_ELC	Min Share of ELC in RH4	RH4*	*RES.HEAT.R4:*	*.ELC.*	MIN
S_RH4_NGA	Min Share of NGA in RH4	RH4*	*RES.HEAT.R4:*	*.NGA.*	MIN
S_RH4_DST	Min Share of DST in RH4	RH4*	*RES.HEAT.R4:*	*.DST.*	MIN
S_RH4_HFO	Min Share of HFO in RH4	RH4*	*RES.HEAT.R4:*	*.HFO.*	MIN
S_RH4_KER	Min Share of KER in RH4	RH4*	*RES.HEAT.R4:*	*.KER.*	MIN
S_RH4_COA	Min Share of COA in RH4	RH4*	*RES.HEAT.R4:*	*.COA.*	MIN
S_RH4_LPG	Min Share of LPG in RH4	RH4*	*RES.HEAT.R4:*	*.LPG.*	MIN
S_RH4_BIO	Min Share of BIO in RH4	RH4*	*RES.HEAT.R4:*	*.BIO.*	MIN
S_RH4_HET	Min Share of HET in RH4	RH4*	*RES.HEAT.R4:*	*.HET.*	MIN
S_RH4_GEO	Min Share of GEO in RH4	RH4*	*RES.HEAT.R4:*	*.GEO.*	MIN
S_RH4_EHP	Min Share of ELC-HEAT PUMP in RH4	RH4*	*.ELC.*	*.HEAT PUMP.*	MIN
S_RH4_ERS	Min Share of ELC-RESISTANCE in RH4	RH4*	*.ELC.*	*.RESISTANCE.*	MIN
S_RH4_NHP	Min Share of NGA-HEAT PUMP in RH4	RH4*	*.NGA.*	*.HEAT PUMP.*	MIN
S_RH4_NBU	Min Share of NGA-BURNER in RH4	RH4*	*.NGA.*	*.BURNER.*	MIN
S_RH4_EHS	Min Share of ELC-HEAT PUMP-Standard in RH4	RH4*	*.ELC.INS-___.HEAT PUMP.*	*.STD.*	MIN
S_RH4_EHI	Min Share of ELC-HEAT PUMP-Improved in RH4	RH4*	*.ELC.INS-___.HEAT PUMP.*	*.IMP.*	MIN
S_RH4_EHA	Min Share of ELC-HEAT PUMP-Advanced in RH4	RH4*	*.ELC.INS-___.HEAT PUMP.*	*.ADV.*	MIN
S_RH4_EBS	Min Share of NGA-BURNER-Standard in RH4	RH4*	*.NGA.INS-___.BURNER.*	*.STD.*	MIN
S_RH4_EBI	Min Share of NGA-BURNER-Improved in RH4	RH4*	*.NGA.INS-___.BURNER.*	*.IMP.*	MIN
S_RH4_EBN	Min Share of NGA-BURNER-New in RH4	RH4*	*.NGA.INS-___.BURNER.*	*.NEW.*	MIN
S_RH4_NHS	Min Share of NGA-HEAT PUMP-Standard in RH4	RH4*	*.NGA.INS-___.HEAT PUMP.*	*.STD.*	MIN
S_RH4_NHH	Min Share of NGA-HEAT PUMP-Hicool in RH4	RH4*	*.NGA.INS-___.HEAT PUMP.*	*.HICOOL.*	MIN
Residential Cooking					
S_RK1_ELC	Min Share of ELC in RK1	RK1*	*RES.COOK.R1:*	*.ELC.*	MIN
S_RK1_NGA	Min Share of NGA in RK1	RK1*	*RES.COOK.R1:*	*.NGA.*	MIN
S_RK1_KER	Min Share of KER in RK1	RK1*	*RES.COOK.R1:*	*.KER.*	MIN
S_RK1_COA	Min Share of COA in RK1	RK1*	*RES.COOK.R1:*	*.COA.*	MIN
S_RK1_LPG	Min Share of LPG in RK1	RK1*	*RES.COOK.R1:*	*.LPG.*	MIN
S_RK1_BIO	Min Share of BIO in RK1	RK1*	*RES.COOK.R1:*	*.BIO.*	MIN

Constraint	Description	Demand Segment	BigSet definition	Subset definition	Max/Min share
S_RK1_SOL	Min Share of SOL in RK1	RK1*	*RES.COOK.R1:*	*.SOL.*	MIN
S_RK2_ELC	Min Share of ELC in RK2	RK2*	*RES.COOK.R2:*	*.ELC.*	MIN
S_RK2_NGA	Min Share of NGA in RK2	RK2*	*RES.COOK.R2:*	*.NGA.*	MIN
S_RK2_KER	Min Share of KER in RK2	RK2*	*RES.COOK.R2:*	*.KER.*	MIN
S_RK2_COA	Min Share of COA in RK2	RK2*	*RES.COOK.R2:*	*.COA.*	MIN
S_RK2_LPG	Min Share of LPG in RK2	RK2*	*RES.COOK.R2:*	*.LPG.*	MIN
S_RK2_BIO	Min Share of BIO in RK2	RK2*	*RES.COOK.R2:*	*.BIO.*	MIN
S_RK2_SOL	Min Share of SOL in RK2	RK2*	*RES.COOK.R2:*	*.SOL.*	MIN
S_RK3_ELC	Min Share of ELC in RK3	RK3*	*RES.COOK.R3:*	*.ELC.*	MIN
S_RK3_NGA	Min Share of NGA in RK3	RK3*	*RES.COOK.R3:*	*.NGA.*	MIN
S_RK3_KER	Min Share of KER in RK3	RK3*	*RES.COOK.R3:*	*.KER.*	MIN
S_RK3_COA	Min Share of COA in RK3	RK3*	*RES.COOK.R3:*	*.COA.*	MIN
S_RK3_LPG	Min Share of LPG in RK3	RK3*	*RES.COOK.R3:*	*.LPG.*	MIN
S_RK3_BIO	Min Share of BIO in RK3	RK3*	*RES.COOK.R3:*	*.BIO.*	MIN
S_RK3_SOL	Min Share of SOL in RK3	RK3*	*RES.COOK.R3:*	*.SOL.*	MIN
S_RK4_ELC	Min Share of ELC in RK4	RK4*	*RES.COOK.R4:*	*.ELC.*	MIN
S_RK4_NGA	Min Share of NGA in RK4	RK4*	*RES.COOK.R4:*	*.NGA.*	MIN
S_RK4_KER	Min Share of KER in RK4	RK4*	*RES.COOK.R4:*	*.KER.*	MIN
S_RK4_COA	Min Share of COA in RK4	RK4*	*RES.COOK.R4:*	*.COA.*	MIN
S_RK4_LPG	Min Share of LPG in RK4	RK4*	*RES.COOK.R4:*	*.LPG.*	MIN
S_RK4_BIO	Min Share of BIO in RK4	RK4*	*RES.COOK.R4:*	*.BIO.*	MIN
S_RK4_SOL	Min Share of SOL in RK4	RK4*	*RES.COOK.R4:*	*.SOL.*	MIN
Residential Hot Water					
S_RHW_ELC	Min Share of ELC in RHW	RHW*	*.WATER HEATER.*	*.ELC.*	MIN
S_RHW_NGA	Min Share of NGA in RHW	RHW*	*.WATER HEATER.*	*.NGA.*	MIN
S_RHW_DST	Min Share of DST in RHW	RHW*	*.WATER HEATER.*	*.DST.*	MIN
S_RHW_KER	Min Share of KER in RHW	RHW*	*.WATER HEATER.*	*.KER.*	MIN
S_RHW_COA	Min Share of COA in RHW	RHW*	*.WATER HEATER.*	*.COA.*	MIN
S_RHW_LPG	Min Share of LPG in RHW	RHW*	*.WATER HEATER.*	*.LPG.*	MIN
S_RHW_BIO	Min Share of BIO in RHW	RHW*	*.WATER HEATER.*	*.BIO.*	MIN
S_RHW_SOL	Min Share of SOL in RHW	RHW*	*.WATER HEATER.*	*.SOL.*	MIN
S_RHW_ELH	Min Share of ELC-RESISTANCE in RHW	RHW*	*.ELC.*	*.RESISTANCE.*	MIN
S_RHW_ELR	Min Share of ELC-HEAT PUMP in RHW	RHW*	*.ELC.*	*.HEAT PUMP.*	MIN

Constraint	Description	Demand Segment	BigSet definition	Subset definition	Max/Min share
Residential Appliances					
S_RCD_ELC	Min Share of ELC in RCD	RCD*	*.CLOTH DRIERS.*	*.ELC.*	MIN
S_RCD_NGA	Min Share of NGA in RCD	RCD*	*.CLOTH DRIERS.*	*.NGA.*	MIN
S_RCD_ELS	Min Share of ELC-Standard in RCD	RCD*	*.ELC.CLOTH DRIERS.*	*.STD.*	MIN
S_RCD_ELI	Min Share of ELC-Improved in RCD	RCD*	*.ELC.CLOTH DRIERS.*	*.IMP.*	MIN
S_RCW_ELS	Min Share of ELC-Standard in RCW	RCW*	*.CLOTH WASHING.*	*.STD.*	MIN
S_RCW_ELM	Min Share of ELC-Mid Temp in RCW	RCW*	*.CLOTH WASHING.*	*.MID TEMP.*	MIN
S_RCW_ELL	Min Share of ELC-Low Temp in RCW	RCW*	*.CLOTH WASHING.*	*.LOW TEMP.*	MIN
S_RCW_ELR	Min Share of ELC-Reduced Water in RCW	RCW*	*.CLOTH WASHING.*	*.REDUCED WATER.*	MIN
S_RCW_ELU	Min Share of ELC-Ultra Sound in RCW	RCW*	*.CLOTH WASHING.*	*.ULTRA SOUND.*	MIN
S_RDW_ELS	Min Share of ELC-Standard in RDW	RDW*	*.DISH WASHER.*	*.STD.*	MIN
S_RDW_ELI	Min Share of ELC-Improved in RDW	RDW*	*.DISH WASHER.*	*.IMP.*	MIN
S_RDW_ELA	Min Share of ELC-Advanced in RDW	RDW*	*.DISH WASHER.*	*.ADV.*	MIN
S_RRF_ELS	Min Share of ELC-Standard in RRF	RRF*	*.REFRIGERATORS.*	*.STD.*	MIN
S_RRF_ELI	Min Share of ELC-Improved in RRF	RRF*	*.REFRIGERATORS.*	*.IMP.*	MIN
S_RRF_ELG	Min Share of ELC-Golden Carrot in RRF	RRF*	*.REFRIGERATORS.*	*.GOLDEN CARROT.*	MIN
Residential Other Equipments					
S_ROT_NGA	Min Share of NGA in ROT	ROT*	*.EQUIPMENT.*	*.NGA.*	MIN
S_ROT_DST	Min Share of DST in ROT	ROT*	*.EQUIPMENT.*	*.DST.*	MIN
S_ROT_HFO	Min Share of HFO in ROT	ROT*	*.EQUIPMENT.*	*.HFO.*	MIN
S_ROT_KER	Min Share of KER in ROT	ROT*	*.EQUIPMENT.*	*.KER.*	MIN
S_ROT_COA	Min Share of COA in ROT	ROT*	*.EQUIPMENT.*	*.COA.*	MIN
S_ROT_LPG	Min Share of LPG in ROT	ROT*	*.EQUIPMENT.*	*.LPG.*	MIN
S_ROT_BIO	Min Share of BIO in ROT	ROT*	*.EQUIPMENT.*	*.BIO.*	MIN
S_ROT_HET	Min Share of HET in ROT	ROT*	*.EQUIPMENT.*	*.HET.*	MIN
S_ROT_GEO	Min Share of GEO in ROT	ROT*	*.EQUIPMENT.*	*.GEO.*	MIN
S_ROT_SOL	Min Share of SOL in ROT	ROT*	*.EQUIPMENT.*	*.SOL.*	MIN

Table A 5. Maximum share User-defined constraints in the residential and the commercial sectors

Constraint	Description	Demand Segment	BigSet definition	Subset definition	Max/Min share
S_RH1_BIU	Max Share of BIO in RH1	RH1*	*RES.HEAT.R1:*	*.BIO.*	MAX
S_RH1_HEU	Max Share of HET in RH1	RH1*	*RES.HEAT.R1:*	*.HET.*	MAX
S_RH1_GEU	Max Share of GEO in RH1	RH1*	*RES.HEAT.R1:*	*.GEO.*	MAX
S_CH1_BIU	Max Share of BIO in CH1	CH1*	*COM.HEAT.R1:*	*.BIO.*	MAX
S_CH1_HEU	Max Share of HET in CH1	CH1*	*COM.HEAT.R1:*	*.HET.*	MAX
S_CH1_GEU	Max Share of GEO in CH1	CH1*	*COM.HEAT.R1:*	*.GEO.*	MAX
S_RH2_BIU	Max Share of BIO in RH2	RH2*	*RES.HEAT.R2:*	*.BIO.*	MAX
S_RH2_HEU	Max Share of HET in RH2	RH2*	*RES.HEAT.R2:*	*.HET.*	MAX
S_RH2_GEU	Max Share of GEO in RH2	RH2*	*RES.HEAT.R2:*	*.GEO.*	MAX
S_CH2_BIU	Max Share of BIO in CH2	CH2*	*COM.HEAT.R2:*	*.BIO.*	MAX
S_CH2_HEU	Max Share of HET in CH2	CH2*	*COM.HEAT.R2:*	*.HET.*	MAX
S_CH2_GEU	Max Share of GEO in CH2	CH2*	*COM.HEAT.R2:*	*.GEO.*	MAX
S_RH3_BIU	Max Share of BIO in RH3	RH3*	*RES.HEAT.R3:*	*.BIO.*	MAX
S_RH3_HEU	Max Share of HET in RH3	RH3*	*RES.HEAT.R3:*	*.HET.*	MAX
S_RH3_GEU	Max Share of GEO in RH3	RH3*	*RES.HEAT.R3:*	*.GEO.*	MAX
S_CH3_BIU	Max Share of BIO in CH3	CH3*	*COM.HEAT.R3:*	*.BIO.*	MAX
S_CH3_HEU	Max Share of HET in CH3	CH3*	*COM.HEAT.R3:*	*.HET.*	MAX
S_CH3_GEU	Max Share of GEO in CH3	CH3*	*COM.HEAT.R3:*	*.GEO.*	MAX
S_RH4_BIU	Max Share of BIO in RH4	RH4*	*RES.HEAT.R4:*	*.BIO.*	MAX
S_RH4_HEU	Max Share of HET in RH4	RH4*	*RES.HEAT.R4:*	*.HET.*	MAX
S_RH4_GEU	Max Share of GEO in RH4	RH4*	*RES.HEAT.R4:*	*.GEO.*	MAX
S_CH4_BIU	Max Share of BIO in CH4	CH4*	*COM.HEAT.R4:*	*.BIO.*	MAX
S_CH4_HEU	Max Share of HET in CH4	CH4*	*COM.HEAT.R4:*	*.HET.*	MAX
S_CH4_GEU	Max Share of GEO in CH4	CH4*	*COM.HEAT.R4:*	*.GEO.*	MAX
S_CHW_SOU	Max Share of SOL in CHW	CHW*	*.WATER HEATER.*	*.SOL.*	MAX
S_RK1_BIU	Max Share of BIO in RK1	RK1*	*RES.COOK.R1:*	*.BIO.*	MAX
S_RK1_SOU	Max Share of SOL in RK1	RK1*	*RES.COOK.R1:*	*.SOL.*	MAX
S_RK2_BIU	Max Share of BIO in RK2	RK2*	*RES.COOK.R2:*	*.BIO.*	MAX
S_RK2_SOU	Max Share of SOL in RK2	RK2*	*RES.COOK.R2:*	*.SOL.*	MAX
S_RK3_BIU	Max Share of BIO in RK3	RK3*	*RES.COOK.R3:*	*.BIO.*	MAX
S_RK3_SOU	Max Share of SOL in RK3	RK3*	*RES.COOK.R3:*	*.SOL.*	MAX
S_RK4_BIU	Max Share of BIO in RK4	RK4*	*RES.COOK.R4:*	*.BIO.*	MAX

Constraint	Description	Demand Segment	BigSet definition	Subset definition	Max/Min share
S_RK4_SOU	Max Share of SOL in RK4	RK4*	*RES.COOK.R4:*	*.SOL.*	MAX
S_RHW_BIU	Max Share of BIO in RHW	RHW*	*.WATER HEATER.*	*.BIO.*	MAX
S_RHW_SOU	Max Share of SOL in RHW	RHW*	*.WATER HEATER.*	*.SOL.*	MAX

Table A 6. Share User-defined constraints in the industrial sector

Constraint	Description	BigSet definition	Subset definition	Max/Min share
Non ferrous metals				
S_IPNFHFO	MIN Share of HFO in IPNF	IPNF	INDHFO	MIN
S_IPNFOIL	MIN Share of OIL in IPNF	IPNF	INDOIL	MIN
S_IPNFNGA	MIN Share of NGA in IPNF	IPNF	INDNGA	MIN
S_IPNFCOA	MIN Share of COA in IPNF	IPNF	INDCOA	MIN
S_IPNFELC	MIN Share of ELC in IPNF	IPNF	INDELC	MIN
S_IPNFLPG	MIN Share of LPG in IPNF	IPNF	INDLPG	MIN
S_IMNFHFO	MIN Share of HFO in IMNF	IMNF	INDHFO	MIN
S_IMNFOIL	MIN Share of OIL in IMNF	IMNF	INDOIL	MIN
S_IMNFNGA	MIN Share of NGA in IMNF	IMNF	INDNGA	MIN
S_IMNFCOA	MIN Share of COA in IMNF	IMNF	INDCOA	MIN
S_IMNFELC	MIN Share of ELC in IMNF	IMNF	INDELC	MIN
S_IMNFLPG	MIN Share of LPG in IMNF	IMNF	INDLPG	MIN
S_IONFHFO	MIN Share of HFO in IONF	IONF	INDHFO	MIN
S_IONFOIL	MIN Share of OIL in IONF	IONF	INDOIL	MIN
S_IONFNGA	MIN Share of NGA in IONF	IONF	INDNGA	MIN
S_IONFELC	MIN Share of ELC in IONF	IONF	INDELC	MIN
S_IONFBIO	MIN Share of BIO in IONF	IONF	INDBIO	MIN
Iron and steel				
S_IPISHFO	MIN Share of HFO in IPIS	IPIS	INDHFO	MIN
S_IPISOIL	MIN Share of OIL in IPIS	IPIS	INDOIL	MIN
S_IPISNGA	MIN Share of NGA in IPIS	IPIS	INDNGA	MIN
S_IPISCOA	MIN Share of COA in IPIS	IPIS	INDCOA	MIN
S_IPISELC	MIN Share of ELC in IPIS	IPIS	INDELC	MIN
S_IPISCOG	MIN Share of COG in IPIS	IPIS	INDCOG	MIN
S_IPISBFG	MIN Share of BFG in IPIS	IPIS	INDBFG	MIN
S_IPISLPG	MIN Share of LPG in IPIS	IPIS	INDLPG	MIN
S_IMISHFO	MIN Share of HFO in IMIS	IMIS	INDHFO	MIN
S_IMISOIL	MIN Share of OIL in IMIS	IMIS	INDOIL	MIN
S_IMISNGA	MIN Share of NGA in IMIS	IMIS	INDNGA	MIN
S_IMISCOA	MIN Share of COA in IMIS	IMIS	INDCOA	MIN
S_IMISELC	MIN Share of ELC in IMIS	IMIS	INDELC	MIN
S_IMISLPG	MIN Share of LPG in IMIS	IMIS	INDLPG	MIN
S_IOISHFO	MIN Share of HFO in IOIS	IOIS	INDHFO	MIN
S_IOISOIL	MIN Share of OIL in IOIS	IOIS	INDOIL	MIN
S_IOISNGA	MIN Share of NGA in IOIS	IOIS	INDNGA	MIN
S_IOISELC	MIN Share of ELC in IOIS	IOIS	INDELC	MIN
S_IOISBIO	MIN Share of BIO in IOIS	IOIS	INDBIO	MIN
Chemicals				
S_IPCHHFO	MIN Share of HFO in IPCH	IPCH	INDHFO	MIN
S_IPCHOIL	MIN Share of OIL in IPCH	IPCH	INDOIL	MIN
S_IPCHNGA	MIN Share of NGA in IPCH	IPCH	INDNGA	MIN
S_IPCHCOA	MIN Share of COA in IPCH	IPCH	INDCOA	MIN
S_IPCHELC	MIN Share of ELC in IPCH	IPCH	INDELC	MIN
S_IPCHLPG	MIN Share of LPG in IPCH	IPCH	INDLPG	MIN
S_IMCHHFO	MIN Share of HFO in IMCH	IMCH	INDHFO	MIN

Constraint	Description	BigSet definition	Subset definition	Max/Min share
S_IMCHOIL	MIN Share of OIL in IMCH	IMCH	INDOIL	MIN
S_IMCHNGA	MIN Share of NGA in IMCH	IMCH	INDNGA	MIN
S_IMCHCOA	MIN Share of COA in IMCH	IMCH	INDCOA	MIN
S_IMCHELC	MIN Share of ELC in IMCH	IMCH	INDELC	MIN
S_IMCHLPG	MIN Share of LPG in IMCH	IMCH	INDLPG	MIN
S_IOCHHFO	MIN Share of HFO in IOCH	IOCH	INDHFO	MIN
S_IOCHOIL	MIN Share of OIL in IOCH	IOCH	INDOIL	MIN
S_IOCHNGA	MIN Share of NGA in IOCH	IOCH	INDNGA	MIN
S_IOCHELC	MIN Share of ELC in IOCH	IOCH	INDELC	MIN
S_IOCHLPG	MIN Share of LPG in IOCH	IOCH	INDLPG	MIN
S_IOCHBIO	MIN Share of BIO in IOCH	IOCH	INDBIO	MIN
S_IFCHNGA	MIN Share of NGA in IFCH	IFCH	GASNGA	MIN
S_IFCHLPG	MIN Share of LPG in IFCH	IFCH	GASLPG	MIN
S_IFCHNGL	MIN Share of NGL in IFCH	IFCH	OILNGL	MIN
S_IFCHCOA	MIN Share of COA in IFCH	IFCH	COAHCO	MIN
S_IFCHCOK	MIN Share of COK in IFCH	IFCH	COAOVC	MIN
S_IFCHHFO	MIN Share of HFO in IFCH	IFCH	OILHFO	MIN
S_IFCHOIL	MIN Share of OIL in IFCH	IFCH	OILDST	MIN
S_IFCHETH	MIN Share of ETH in IFCH	IFCH	GASETH	MIN
S_IFCHNAP	MIN Share of NAP in IFCH	IFCH	OILNAP	MIN
S_IFCHBIO	MIN Share of BIO in IFCH	IFCH	BIOGAS	MIN
Non metal minerals				
S_IPNMHFO	MIN Share of HFO in IPNM	IPNM	INDHFO	MIN
S_IPNMOIL	MIN Share of OIL in IPNM	IPNM	INDOIL	MIN
S_IPNMNGA	MIN Share of NGA in IPNM	IPNM	INDNGA	MIN
S_IPNMCOA	MIN Share of COA in IPNM	IPNM	INDCOA	MIN
S_IPNMCOK	MIN Share of COK in IPNM	IPNM	INDCOK	MIN
S_IPNMPTC	MIN Share of PTC in IPNM	IPNM	INDPTC	MIN
S_IPNMELC	MIN Share of ELC in IPNM	IPNM	INDELC	MIN
S_IPNMLPG	MIN Share of LPG in IPNM	IPNM	INDLPG	MIN
S_IPNMHET	MIN Share of HET in IPNM	IPNM	INDHET	MIN
S_IMNMHFO	MIN Share of HFO in IMNM	IMNM	INDHFO	MIN
S_IMNMOIL	MIN Share of OIL in IMNM	IMNM	INDOIL	MIN
S_IMNMNGA	MIN Share of NGA in IMNM	IMNM	INDNGA	MIN
S_IMNMCOA	MIN Share of COA in IMNM	IMNM	INDCOA	MIN
S_IMNMELC	MIN Share of ELC in IMNM	IMNM	INDELC	MIN
S_IMNMLPG	MIN Share of LPG in IMNM	IMNM	INDLPG	MIN
S_IONMHFO	MIN Share of HFO in IONM	IONM	INDHFO	MIN
S_IONMOIL	MIN Share of OIL in IONM	IONM	INDOIL	MIN
S_IONMNGA	MIN Share of NGA in IONM	IONM	INDNGA	MIN
S_IONMELC	MIN Share of ELC in IONM	IONM	INDELC	MIN
S_IONMLPG	MIN Share of LPG in IONM	IONM	INDLPG	MIN
S_IONMNGL	MIN Share of NGL in IONM	IONM	INDNGL	MIN
S_IONMBIO	MIN Share of BIO in IONM	IONM	INDBIO	MIN
Pulp and paper				
S_IPLPHFO	MIN Share of HFO in IPLP	IPLP	INDHFO	MIN
S_IPLPOIL	MIN Share of OIL in IPLP	IPLP	INDOIL	MIN

Constraint	Description	BigSet definition	Subset definition	Max/Min share
S_IPLPNGA	MIN Share of NGA in IPLP	IPLP	INDNGA	MIN
S_IPLPCOA	MIN Share of COA in IPLP	IPLP	INDCOA	MIN
S_IPLPELC	MIN Share of ELC in IPLP	IPLP	INDELC	MIN
S_IPLPLPG	MIN Share of LPG in IPLP	IPLP	INDLPG	MIN
S_IMLPHFO	MIN Share of HFO in IMLP	IMLP	INDHFO	MIN
S_IMLPOIL	MIN Share of OIL in IMLP	IMLP	INDOIL	MIN
S_IMLPNGA	MIN Share of NGA in IMLP	IMLP	INDNGA	MIN
S_IMLPCOA	MIN Share of COA in IMLP	IMLP	INDCOA	MIN
S_IMLPELC	MIN Share of ELC in IMLP	IMLP	INDELC	MIN
S_IMLPLPG	MIN Share of LPG in IMLP	IMLP	INDLPG	MIN
S_IOLPHFO	MIN Share of HFO in IOLP	IOLP	INDHFO	MIN
S_IOLPOIL	MIN Share of OIL in IOLP	IOLP	INDOIL	MIN
S_IOLPNGA	MIN Share of NGA in IOLP	IOLP	INDNGA	MIN
S_IOLPELC	MIN Share of ELC in IOLP	IOLP	INDELC	MIN
S_IOLPLPG	MIN Share of LPG in IOLP	IOLP	INDLPG	MIN
S_IOLPNGL	MIN Share of NGL in IOLP	IOLP	INDNGL	MIN
S_IOLPCOA	MIN Share of COA in IOLP	IOLP	INDCOA	MIN
S_IOLPCOK	MIN Share of COK in IOLP	IOLP	INDCOK	MIN
S_IOLPCOG	MIN Share of COG in IOLP	IOLP	INDCOG	MIN
S_IOLPNAP	MIN Share of NAP in IOLP	IOLP	INDNAP	MIN
S_IOLPPTC	MIN Share of PTC in IOLP	IOLP	INDPTC	MIN
Other industries				
S_IPOINGA	MIN Share of NGA in IPOI	IPOI	INDNGA	MIN
S_IPOIOIL	MIN Share of DST in IPOI	IPOI	INDOIL	MIN
S_IPOIHFO	MIN Share of HFO in IPOI	IPOI	INDHFO	MIN
S_IPOICOA	MIN Share of COA in IPOI	IPOI	INDCOA	MIN
S_IPOIELC	MIN Share of ELC in IPOI	IPOI	INDELC	MIN
S_IPOILPG	MIN Share of LPG in IPOI	IPOI	INDLPG	MIN
S_IMOIELC	MIN Share of ELC in IMOI	IMOI	INDELC	MIN
S_IMOINGA	MIN Share of NGA in IMOI	IMOI	INDNGA	MIN
S_IMOIOIL	MIN Share of DST in IMOI	IMOI	INDOIL	MIN
S_IMOIHFO	MIN Share of HFO in IMOI	IMOI	INDHFO	MIN
S_IMOICOA	MIN Share of COA in IMOI	IMOI	INDCOA	MIN
S_IMOILPG	MIN Share of LPG in IMOI	IMOI	INDLPG	MIN
S_IOOINGA	MIN Share of NGA in IOOI	IOOI	INDNGA	MIN
S_IOOIOIL	MIN Share of DST in IOOI	IOOI	INDOIL	MIN
S_IOOIHFO	MIN Share of HFO in IOOI	IOOI	INDHFO	MIN
S_IOOICOA	MIN Share of COA in IOOI	IOOI	INDCOA	MIN
S_IOOIELC	MIN Share of ELC in IOOI	IOOI	INDELC	MIN
S_IOOIGEO	MIN Share of GEO in IOOI	IOOI	INDGEO	MIN
S_IOOIHET	MIN Share of HET in IOOI	IOOI	INDHET	MIN
S_IOOILPG	MIN Share of LPG in IOOI	IOOI	INDLPG	MIN
S_IOOIBIO	MIN Share of BIO in IOOI	IOOI	INDBIO	MIN
S_INOIHCO	MIN Share of HCO in INOI	INOI	COAHCO	MIN
S_INOIOVC	MIN Share of OVC in INOI	INOI	COAOVC	MIN
S_INOICRD	MIN Share of CRD in INOI	INOI	OILCRD	MIN
S_INOINSP	MIN Share of NSP in INOI	INOI	OILNSP	MIN

Constraint	Description	BigSet definition	Subset definition	Max/Min share
S_INOIPTC	MIN Share of PTC in INOI	INOI	OILPTC	MIN
S_INOIWSP	MIN Share of WSP in INOI	INOI	OILWSP	MIN
S_INOILUB	MIN Share of LUB in INOI	INOI	OILLUB	MIN
S_INOIASP	MIN Share of ASP in INOI	INOI	OILASP	MIN
S_INOIWAX	MIN Share of WAX in INOI	INOI	OILWAX	MIN
Other User-defined constraints				
S_INDGEO	Max share IND Geothermal	IND*	INDGEO*	MAX
A_COACGEN	Max cogen from Coal	INDCOA	ES*	MAX

Table A 7. Share User-defined constraints for industrial cogeneration

Constraint	Description	BigSet definition	Subset definition	Max/Min share
Split between steam and CHP technologies				
S_ISNFCHP	Min share of steam technologies (IS) in ISNF	ISNF	IS*	MIN
S_ESNFCHP	Min share of CHP (ES) in ISNF	ISNF	ES*	MIN
S_ISISCHP	Min share of steam technologies (IS) in ISIS	ISIS	IS*	MIN
S_ESISCHP	Min share of CHP (ES) in ISIS	ISIS	ES*	MIN
S_ISCHCHP	Min share of steam technologies (IS) in ISCH	ISCH	IS*	MIN
S_ESCHCHP	Min share of CHP (ES) in ISCH	ISCH	ES*	MIN
S_ISNMCHP	Min share of steam technologies (IS) in ISNM	ISNM	IS*	MIN
S_ESNMCHP	Min share of CHP (ES) in ISNM	ISNM	ES*	MIN
S_ISLPCHP	Min share of steam technologies (IS) in ISLP	ISLP	IS*	MIN
S_ESLPCHP	Min share of CHP (ES) in ISLP	ISLP	ES*	MIN
S_ISOICHP	Min share of steam technologies (IS) in ISOI	ISOI	IS*	MIN
S_ESOICHP	Min share of CHP (ES) in ISOI	ISOI	ES*	MIN
Split between fuels for steam technologies				
S_ISNFHFO	MIN Share of HFO in ISNF	ISNF*	INDHFO	MIN
S_ISNFOIL	MIN Share of OIL in ISNF	ISNF*	INDOIL	MIN
S_ISNFNGA	MIN Share of NGA in ISNF	ISNF*	INDNGA	MIN
S_ISNFCOA	MIN Share of COA in ISNF	ISNF*	INDCOA	MIN
S_ISISHFO	MIN Share of HFO in ISIS	ISIS*	INDHFO	MIN
S_ISISOIL	MIN Share of OIL in ISIS	ISIS*	INDOIL	MIN
S_ISISNGA	MIN Share of NGA in ISIS	ISIS*	INDNGA	MIN
S_ISISCOA	MIN Share of COA in ISIS	ISIS*	INDCOA	MIN
S_ISCHHFO	MIN Share of HFO in ISCH	ISCH*	INDHFO	MIN
S_ISCHOIL	MIN Share of OIL in ISCH	ISCH*	INDOIL	MIN
S_ISCHNGA	MIN Share of NGA in ISCH	ISCH*	INDNGA	MIN
S_ISCHCOA	MIN Share of COA in ISCH	ISCH*	INDCOA	MIN
S_ISCHELC	MIN Share of ELC in ISCH	ISCH*	INDELC	MIN
S_ISNMHFO	MIN Share of HFO in ISNM	ISNM*	INDHFO	MIN
S_ISNMOIL	MIN Share of OIL in ISNM	ISNM*	INDOIL	MIN
S_ISNMNGA	MIN Share of NGA in ISNM	ISNM*	INDNGA	MIN
S_ISNMCOA	MIN Share of COA in ISNM	ISNM*	INDCOA	MIN
S_ISNMELC	MIN Share of ELC in ISNM	ISNM*	INDELC	MIN
S_ISLPHFO	MIN Share of HFO in ISLP	ISLP*	INDHFO	MIN
S_ISLPOIL	MIN Share of OIL in ISLP	ISLP*	INDOIL	MIN
S_ISLPNGA	MIN Share of NGA in ISLP	ISLP*	INDNGA	MIN
S_ISLPCOA	MIN Share of COA in ISLP	ISLP*	INDCOA	MIN
S_ISLPELC	MIN Share of ELC in ISLP	ISLP*	INDELC	MIN
S_ISLPBIO	MIN Share of BIO in ISLP	ISLP*	INDBIO	MIN
S_ISLPHET	MIN Share of HET in ISLP	ISLP*	INDHET	MIN
S_ISOINGA	MIN Share of NGA in ISOI	ISOI*	INDNGA	MIN
S_ISOIOIL	MIN Share of DST in ISOI	ISOI*	INDOIL	MIN
S_ISOIHFO	MIN Share of HFO in ISOI	ISOI*	INDHFO	MIN
S_ISOICOA	MIN Share of COA in ISOI	ISOI*	INDCOA	MIN
S_ISOIELC	MIN Share of ELC in ISOI	ISOI*	INDELC	MIN
S_ISOILPG	MIN Share of LPG in ISOI	ISOI*	INDLPG	MIN

Constraint	Description	BigSet definition	Subset definition	Max/Min share
Split between fuels for CHP technologies				
S_ESNFHFO	MIN Share of HFO in ESNF	ESNF*	INDHFO	MIN
S_ESNFNGA	MIN Share of NGA in ESNF	ESNF*	INDNGA	MIN
S_ESNFCOA	MIN Share of COA in ESNF	ESNF*	INDCOA	MIN
S_ESISHFO	MIN Share of HFO in ESIS	ESIS*	INDHFO	MIN
S_ESISNGA	MIN Share of NGA in ESIS	ESIS*	INDNGA	MIN
S_ESISCOA	MIN Share of COA in ESIS	ESIS*	INDCOA	MIN
S_ESISBFG	MIN Share of COA in ESIS	ESIS*	INDBFG	MIN
S_ESCHHFO	MIN Share of HFO in ESCH	ESCH*	INDHFO	MIN
S_ESCHNGA	MIN Share of NGA in ESCH	ESCH*	INDNGA	MIN
S_ESCHCOA	MIN Share of COA in ESCH	ESCH*	INDCOA	MIN
S_ESNMHFO	MIN Share of HFO in ESNM	ESNM*	INDHFO	MIN
S_ESNMNGA	MIN Share of NGA in ESNM	ESNM*	INDNGA	MIN
S_ESNMCOA	MIN Share of COA in ESNM	ESNM*	INDCOA	MIN
S_ESLPHFO	MIN Share of HFO in ESLP	ESLP*	INDHFO	MIN
S_ESLPNGA	MIN Share of NGA in ESLP	ESLP*	INDNGA	MIN
S_ESLPCOA	MIN Share of COA in ESLP	ESLP*	INDCOA	MIN
S_ESLPBIO	MIN Share of COA in ESLP	ESLP*	INDBIO	MIN
S_ESOINGA	MIN Share of NGA in ESOI	ESOI*	INDHFO	MIN
S_ESOIHFO	MIN Share of HFO in ESOI	ESOI*	INDNGA	MIN
S_ESOICOA	MIN Share of COA in ESOI	ESOI*	INDCOA	MIN

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Appendix B

Table B 1. Share of transport modes by fuel in AFR

	ROAD										RAIL		
	Light Vehicle	TRT	TRL	TRE	TRW	Other Vehicle	TRB	TRH	TRM	TRC	Total	TTF	TTP
TRACOA											**1.00**	0.80	0.20
TRAMET	**0.00**					**1.00**	1.00						
TRAETH	**0.00**					**1.00**	1.00						
TRANGA													
TRALPG	**0.60**	0.70	0.30			**0.40**	0.30	0.30	0.40				
TRAGSL	**0.80**	0.60	0.39	0.01	0.01	**0.20**	0.10	0.10	0.40	0.40			
TRAAVG													
TRAJTK													
TRADST	**0.15**	0.20	0.80			**0.85**	0.20	0.20	0.30	0.30	**1.00**	0.70	0.30
TRAHFO													
TRAELC											**1.00**	0.10	0.90

Table B 2. Share of transport modes by fuel in AUS

	ROAD										RAIL		
	Light Vehicle	TRT	TRL	TRE	TRW	Other Vehicle	TRB	TRH	TRM	TRC	Total	TTF	TTP
TRACOA													
TRAMET	**1.00**	0.47	0.53			**0.00**							
TRAETH	**1.00**	0.03	0.97			**0.00**							
TRANGA	**0.23**	0.48	0.52			**0.77**	0.81	0.00	0.08	0.11			
TRALPG	**0.94**	0.79	0.21			**0.06**	0.05	0.20	0.38	0.37			
TRAGSL	**0.98**	0.85	0.14	0.01	0.01	**0.02**	0.10	0.05	0.25	0.60			
TRAAVG													
TRAJTK													
TRADST	**0.21**	0.40	0.60			**0.79**	0.10	0.75	0.10	0.05	**1.00**	0.90	0.10
TRAHFO													
TRAELC	**1.00**	0.66	0.34			**0.00**					**1.00**		1.00

Table B 3. Share of transport modes by fuel in CAN

	ROAD										RAIL		
	Light Vehicle	TRT	TRL	TRE	TRW	Other Vehicle	TRB	TRH	TRM	TRC	Total	TTF	TTP
TRACOA													
TRAMET	**1.00**	0.47	0.53			**0.00**							
TRAETH	**1.00**	0.20	0.80			**0.00**							
TRANGA	**0.68**	0.92	0.08			**0.32**	1.00						
TRALPG	**0.90**	0.63	0.37			**0.10**			0.30	0.70			
TRAGSL	**0.97**	0.62	0.38	0.01	0.01	**0.03**	0.01	0.00	0.20	0.79			
TRAAVG													
TRAJTK													
TRADST	**0.02**	0.38	0.62			**0.98**	0.01	0.81	0.13	0.05	**1.00**	0.90	0.10
TRAHFO													
TRAELC	**1.00**	0.66	0.34			**0.00**					**1.00**		1.00

Table B 4. Share of transport modes by fuel in CHI

	ROAD										RAIL		
	Light Vehicle	TRT	TRL	TRE	TRW	Other Vehicle	TRB	TRH	TRM	TRC	Total	TTF	TTP
TRACOA											**1.00**	0.95	0.05
TRAMET	**0.70**	0.80	0.20			**0.30**	0.50		0.50				
TRAETH	**0.70**	0.80	0.20			**0.30**	0.50		0.50				
TRANGA	**0.70**	0.80	0.20			**0.30**	0.70			0.30			
TRALPG	**0.70**	0.67	0.33			**0.30**	0.70			0.30			
TRAGSL	**0.97**	0.57	0.40	0.01	0.03	**0.03**	0.33	0.14	0.20	0.33			
TRAAVG													
TRAJTK													
TRADST	**0.05**	0.35	0.65			**0.95**	0.20	0.50	0.20	0.10	**1.00**	0.90	0.10
TRAHFO											**1.00**	0.90	0.10
TRAELC	**1.00**	0.90	0.10			**0.00**					**1.00**	0.05	0.95

Table B 5. Share of transport modes by fuel in CSA

	ROAD										RAIL		
	Light Vehicle	TRT	TRL	TRE	TRW	Other Vehicle	TRB	TRH	TRM	TRC	Total	TTF	TTP
TRACOA													
TRAMET	**0.80**	0.60	0.40			**0.20**	0.30	0.05	0.20	0.45			
TRAETH	**0.80**	0.60	0.40			**0.20**	0.30	0.05	0.20	0.45			
TRANGA	**0.20**	0.60	0.40			**0.80**	0.60	0.00	0.20	0.20			
TRALPG	**0.15**	0.67	0.33			**0.85**	1.00						
TRAGSL	**0.65**	0.67	0.31	0.01	0.02	**0.35**	0.12	0.03	0.60	0.25			
TRAAVG													
TRAJTK													
TRADST	**0.05**	0.30	0.70			**0.95**	0.30	0.40	0.25	0.05	**1.00**	0.80	0.20
TRAHFO											**1.00**	1.00	
TRAELC	**0.50**	0.70	0.30			**0.50**	1.00				**1.00**	0.05	0.95

Table B 6. Share of transport modes by fuel in EEU

	ROAD										RAIL		
	Light Vehicle	TRT	TRL	TRE	TRW	Other Vehicle	TRB	TRH	TRM	TRC	Total	TTF	TTP
TRACOA											**1.00**	0.80	0.20
TRAMET													
TRAETH													
TRANGA													
TRALPG	**0.57**	0.67	0.33			**0.43**			0.50	0.50			
TRAGSL	**0.80**	0.66	0.33	0.01	0.01	**0.20**	0.05	0.05	0.45	0.45			
TRAAVG													
TRAJTK													
TRADST	**0.04**	0.53	0.47			**0.96**	0.15	0.50	0.20	0.15	**1.00**	0.90	0.10
TRAHFO													
TRAELC											**1.00**	0.10	0.90

Table B 7. Share of transport modes by fuel in FSU

	ROAD										RAIL		
	Light Vehicle	TRT	TRL	TRE	TRW	Other Vehicle	TRB	TRH	TRM	TRC	Total	TTF	TTP
TRACOA											**1.00**	0.80	0.20
TRAMET	**0.80**	0.80	0.20			**0.20**	0.20	0.20	0.20	0.20			
TRAETH	**0.90**	0.80	0.20			**0.10**	0.20	0.20	0.20	0.20			
TRANGA	**0.70**	0.80	0.20			**0.30**			1.00				
TRALPG	**0.57**	0.67	0.33			**0.43**			0.50	0.50			
TRAGSL	**0.90**	0.52	0.46	0.01	0.01	**0.10**	0.05	0.05	0.45	0.45			
TRAAVG													
TRAJTK													
TRADST	**0.03**	0.53	0.47			**0.97**	0.20	0.50	0.20	0.10	**1.00**	0.90	0.10
TRAHFO											**1.00**	0.90	0.10
TRAELC											**1.00**	0.20	0.80

Table B 8. Share of transport modes by fuel in IND

	ROAD										RAIL		
	Light Vehicle	TRT	TRL	TRE	TRW	Other Vehicle	TRB	TRH	TRM	TRC	Total	TTF	TTP
TRACOA											**1.00**	0.80	0.20
TRAMET													
TRAETH													
TRANGA	**0.10**	1.00				**0.90**	0.90			0.10			
TRALPG													
TRAGSL	**0.90**	0.56	0.42	0.01	0.02	**0.10**	0.10	0.05	0.50	0.35			
TRAAVG													
TRAJTK													
TRADST	**0.25**	0.50	0.50			**0.75**	0.15	0.30	0.40	0.15	**1.00**	0.40	0.60
TRAHFO											**1.00**	0.90	0.10
TRAELC											**1.00**	0.30	0.70

Table B 9. Share of transport modes by fuel in JPN

	ROAD										RAIL		
	Light Vehicle	TRT	TRL	TRE	TRW	Other Vehicle	TRB	TRH	TRM	TRC	Total	TTF	TTP
TRACOA													
TRAMET	**1.00**	0.80	0.20			**0.00**							
TRAETH	**1.00**	0.80	0.20			**0.00**							
TRANGA	**0.95**	0.80	0.20			**0.05**			1.00				
TRALPG	**0.57**	0.67	0.33			**0.43**			1.00				
TRAGSL	**1.00**	0.80	0.19	0.01	0.01	**0.00**							
TRAAVG													
TRAJTK													
TRADST	**0.40**	0.46	0.54			**0.60**	0.06	0.07	0.20	0.67	**1.00**	0.30	0.70
TRAHFO													
TRAELC	**1.00**	0.90	0.10			**0.00**					**1.00**		1.00

Table B 10. Share of transport modes by fuel in MEA

	ROAD										RAIL		
	Light Vehicle	TRT	TRL	TRE	TRW	Other Vehicle	TRB	TRH	TRM	TRC	Total	TTF	TTP
TRACOA											**1.00**	0.80	0.20
TRAMET													
TRAETH													
TRANGA													
TRALPG	**0.60**	0.70	0.30			**0.40**	0.30	0.30	0.40				
TRAGSL	**0.65**	0.59	0.39	0.01	0.01	**0.35**	0.10	0.15	0.35	0.40			
TRAAVG													
TRAJTK													
TRADST	**0.10**	0.20	0.80			**0.90**	0.20	0.20	0.30	0.30	**1.00**	0.70	0.30
TRAHFO													
TRAELC											**1.00**	0.10	0.90

Table B 11. Share of transport modes by fuel in MEX

	ROAD										RAIL		
	Light Vehicle	TRT	TRL	TRE	TRW	Other Vehicle	TRB	TRH	TRM	TRC	Total	TTF	TTP
TRACOA													
TRAMET	**0.80**	0.60	0.40			**0.20**	0.30	0.05	0.20	0.45			
TRAETH	**0.80**	0.60	0.40			**0.20**	0.30	0.05	0.20	0.45			
TRANGA	**0.00**		1.00			**1.00**	0.80		0.20				
TRALPG	**0.15**	0.67	0.33			**0.85**	1.00						
TRAGSL	**0.65**	0.65	0.34	0.01	0.02	**0.35**	0.12	0.03	0.60	0.25			
TRAAVG													
TRAJTK													
TRADST	**0.05**	0.30	0.70			**0.95**	0.30	0.40	0.25	0.05	**1.00**	0.80	0.20
TRAHFO													
TRAELC	**0.50**	0.70	0.30			**0.50**	1.00				**1.00**	0.05	0.95

Table B 12. Share of transport modes by fuel in ODA

	ROAD										RAIL		
	Light Vehicle	TRT	TRL	TRE	TRW	Other Vehicle	TRB	TRH	TRM	TRC	Total	TTF	TTP
TRACOA											**1.00**	0.80	0.20
TRAMET	**0.90**	0.80	0.20			**0.10**	0.50		0.50				
TRAETH	**0.90**	0.80	0.20			**0.10**	0.50		0.50				
TRANGA	**0.90**	0.80	0.20			**0.10**	0.70			0.30			
TRALPG	**0.70**	0.67	0.33			**0.30**	0.70			0.30			
TRAGSL	**0.70**	0.57	0.40	0.01	0.03	**0.30**	0.20	0.10	0.35	0.35			
TRAAVG													
TRAJTK													
TRADST	**0.05**	0.35	0.65			**0.95**	0.20	0.50	0.25	0.05	**1.00**	0.80	0.20
TRAHFO											**1.00**	0.90	0.10
TRAELC	**1.00**	0.90	0.10			**0.00**					**1.00**	0.05	0.95

Table B 13. Share of transport modes by fuel in SKO

	ROAD										RAIL		
	Light Vehicle	TRT	TRL	TRE	TRW	Other Vehicle	TRB	TRH	TRM	TRC	Total	TTF	TTP
TRACOA													
TRAMET	**1.00**	0.60	0.40			**0.00**							
TRAETH	**1.00**	0.60	0.40			**0.00**							
TRANGA	**1.00**	0.60	0.40			**0.00**							
TRALPG	**0.80**	0.60	0.40			**0.20**			0.50	0.50			
TRAGSL	**0.98**	0.60	0.38	0.01	0.02	**0.02**	0.20	0.05	0.30	0.45			
TRAAVG													
TRAJTK													
TRADST	**0.10**	0.40	0.60			**0.90**	0.20	0.40	0.20	0.20	**1.00**	0.90	0.10
TRAHFO											**1.00**	0.90	0.10
TRAELC	**1.00**	0.90	0.10			**0.00**					**1.00**	0.20	0.80

Table B 14. Share of transport modes by fuel in USA

	ROAD										RAIL		
	Light Vehicle	TRT	TRL	TRE	TRW	Other Vehicle	TRB	TRH	TRM	TRC	Total	TTF	TTP
TRACOA													
TRAMET	**1.00**	0.47	0.53			**0.00**							
TRAETH	**1.00**	0.03	0.97			**0.00**							
TRANGA	**0.98**	0.52	0.48			**0.02**	0.02	0.05	0.30	0.63			
TRALPG	**0.72**	0.35	0.65			**0.28**	0.02	0.05	0.30	0.63			
TRAGSL	**0.94**	0.58	0.42			**0.06**	0.01	0.04	0.27	0.68			
TRAAVG													
TRAJTK													
TRADST	**0.02**	0.39	0.61			**0.98**	0.04	0.80	0.11	0.05	**1.00**	0.96	0.04
TRAHFO											**1.00**	0.90	0.10
TRAELC	**1.00**	0.66	0.34			**0.00**					**1.00**		1.00

Table B 15. Share of transport modes by fuel in WEU

	ROAD										RAIL		
	Light Vehicle	TRT	TRL	TRE	TRW	Other Vehicle	TRB	TRH	TRM	TRC	Total	TTF	TTP
TRACOA													
TRAMET	**1.00**	0.47	0.53			**0.00**							
TRAETH	**1.00**	0.20	0.80			**0.00**							
TRANGA	**0.68**	0.92	0.08			**0.32**	1.00						
TRALPG	**0.75**	0.63	0.37			**0.25**			0.30	0.70			
TRAGSL	**0.95**	0.64	0.35	0.01	0.01	**0.05**	0.01	0.04	0.27	0.68			
TRAAVG													
TRAJTK													
TRADST	**0.15**	0.80	0.20			**0.85**	0.05	0.55	0.25	0.15	**1.00**	0.90	0.10
TRAHFO													
TRAELC	**1.00**	0.66	0.34			**0.00**					**1.00**		1.00

Table B 16. Energy service demand in AFR

Segment (PJ)	2000	2005	2010	2015	2020	2025	Driver
AGR	219	241	265	291	318	345	1
CC1	41	51	63	78	94	111	1
CC2	/	/	/	/	/	/	
CC3	/	/	/	/	/	/	
CC4	/	/	/	/	/	/	
CCK	25	27	29	32	34	36	3
CH1	41	49	59	71	84	98	1
CH2	/	/	/	/	/	/	
CH3	/	/	/	/	/	/	
CH4	/	/	/	/	/	/	
CHW	24	29	36	45	54	64	1
CLA	186	231	288	354	429	506	1
COE	27	33	42	51	62	73	1
COT	0	0	0	0	0	0	1
CRF	39	42	46	50	53	57	3
ICH	919	1080	1239	1433	1634	1836	1
IIS (Mt)	12	14	15	15	15	15	1
ILP (Mt)	3	4	4	5	6	8	1
INF (Mt)	1	1	1	2	2	2	1
INM (Mt)	44	60	82	119	171	243	1
IOI	1576	1890	2278	2714	3213	3768	1
NEU	0	0	0	0	0	0	1
ONO	1151	1196	1246	1293	1341	1387	1
RC1	107	121	140	159	181	201	3
RC2	/	/	/	/	/	/	
RC3	/	/	/	/	/	/	
RC4	/	/	/	/	/	/	
RCD	4	4	5	5	6	7	3
RCW	4	4	5	5	6	7	3
RDW	4	4	5	5	6	6	3
REA	79	90	103	113	123	132	3
RH1	859	966	1080	1202	1333	1475	2
RH2	/	/	/	/	/	/	
RH3	/	/	/	/	/	/	
RH4	/	/	/	/	/	/	
RHW	918	1032	1154	1284	1424	1577	2
RK1	2877	3144	3423	3714	4017	4339	2
RK2	/	/	/	/	/	/	
RK3	/	/	/	/	/	/	
RK4	/	/	/	/	/	/	
RL1	135	146	159	173	186	198	3
RL2	/	/	/	/	/	/	
RL3	/	/	/	/	/	/	
RL4	/	/	/	/	/	/	
ROT	0	1	1	1	1	1	2
RRF	54	61	71	81	92	102	3
TAD	80	93	109	126	144	161	3
TAI	220	256	302	348	397	445	3
TRB (10^9Vkm)	12	12	13	14	15	16	3
TRC (10^9Vkm)	31	39	49	61	75	90	1
TRE (10^9Vkm)	2	2	2	2	2	2	3
TRH (10^9Vkm)	7	9	11	14	17	20	1
TRL (10^9Vkm)	82	91	102	114	128	141	3
TRM (10^9Vkm)	19	24	31	39	47	57	1
TRT (10^9Vkm)	130	143	161	181	202	223	3
TRW (10^9Vkm)	3	3	4	4	4	5	3
TTF	12	13	14	15	16	17	1
TTP	20	22	23	25	27	29	1
TWD	17	19	21	24	26	29	1
TWI	283	334	389	441	489	531	1

Table B 17. Energy service demand in AUS

Segment (PJ)	2000	2005	2010	2015	2020	2025	Driver
AGR	82	84	85	87	88	89	1
CC1	72	81	92	103	116	130	1
CC2	/	/	/	/	/	/	
CC3	/	/	/	/	/	/	
CC4	/	/	/	/	/	/	
CCK	5	6	6	6	6	6	2
CH1	78	84	92	99	107	116	1
CH2	/	/	/	/	/	/	
CH3	/	/	/	/	/	/	
CH4	/	/	/	/	/	/	
CHW	10	12	13	15	17	19	1
CLA	219	256	300	350	408	473	1
COE	64	77	92	109	128	148	1
COT	0	0	0	0	0	0	1
CRF	9	10	10	10	11	11	2
ICH	230	274	328	392	466	548	1
IIS (Mt)	9	9	10	10	11	12	1
ILP (Mt)	3	4	5	6	8	10	1
INF (Mt)	2	2	3	4	5	6	1
INM (Mt)	9	11	14	17	21	26	1
IOI	489	571	668	781	910	1055	1
NEU	0	0	0	0	0	0	1
ONO	0	0	0	0	0	0	1
RC1	27	28	30	31	32	33	2
RC2	/	/	/	/	/	/	
RC3	/	/	/	/	/	/	
RC4	/	/	/	/	/	/	
RCD	14	14	15	16	16	17	2
RCW	5	5	5	5	5	6	2
RDW	2	2	3	3	3	3	2
REA	57	64	73	83	94	106	3
RH1	180	184	188	192	195	199	2
RH2	/	/	/	/	/	/	
RH3	/	/	/	/	/	/	
RH4	/	/	/	/	/	/	
RHW	49	52	54	56	58	60	2
RK1	10	11	11	11	12	12	2
RK2	/	/	/	/	/	/	
RK3	/	/	/	/	/	/	
RK4	/	/	/	/	/	/	
RL1	31	34	36	38	40	42	2
RL2	/	/	/	/	/	/	
RL3	/	/	/	/	/	/	
RL4	/	/	/	/	/	/	
ROT	0	0	0	0	0	0	2
RRF	29	31	33	34	35	36	2
TAD	86	104	128	156	186	220	1
TAI	132	168	214	268	330	398	1
TRB (10^9Vkm)	2	2	3	3	3	3	2
TRC (10^9Vkm)	3	3	4	5	6	7	1
TRE (10^9Vkm)	1	1	1	1	1	1	2
TRH (10^9Vkm)	9	11	13	16	19	23	1
TRL (10^9Vkm)	35	41	47	54	61	68	1
TRM (10^9Vkm)	2	2	3	3	4	4	1
TRT (10^9Vkm)	206	237	274	315	357	397	1
TRW (10^9Vkm)	2	3	3	3	3	3	2
TTF	37	41	46	51	56	62	1
TTP	14	14	15	15	16	17	2
TWD	37	41	45	50	55	60	1
TWI	84	93	103	115	127	140	1

Table B 18. Energy service demand in CAN

Segment (PJ)	2000	2005	2010	2015	2020	2025	Driver
AGR	205	208	213	223	230	236	1
CC1	56	61	66	71	76	81	4
CC2	111	124	138	153	168	183	5
CC3	26	28	31	34	36	39	6
CC4	/	/	/	/	/	/	
CCK	29	31	32	34	36	37	7
CH1	199	216	232	248	264	281	4
CH2	198	221	245	270	295	320	5
CH3	184	201	219	237	254	271	6
CH4	/	/	/	/	/	/	
CHW	80	85	90	95	99	104	7
CLA	715	789	864	942	1018	1097	7
COE	86	107	133	162	194	229	1
COT	64	65	67	69	70	71	7
CRF	24	26	27	29	30	32	7
ICH	1109	1215	1327	1436	1545	1658	1
IIS (Mt)	16	17	19	20	21	21	1
ILP (Mt)	19	20	24	27	30	33	1
INF (Mt)	2	3	3	4	5	6	1
INM (Mt)	12	14	17	20	23	26	1
IOI	1196	1386	1599	1819	2049	2298	1
NEU	8	9	10	10	11	12	1
ONO	0	0	0	0	0	0	1
RC1	25	26	28	30	32	34	8
RC2	177	188	201	216	233	249	9
RC3	23	25	26	28	29	31	10
RC4	/	/	/	/	/	/	
RCD	40	42	45	48	51	54	11
RCW	4	4	5	5	5	6	11
RDW	3	3	3	4	4	4	11
REA	175	215	260	295	328	362	3
RH1	213	227	241	257	274	290	8
RH2	223	236	251	270	289	309	9
RH3	125	132	138	146	153	160	10
RH4	/	/	/	/	/	/	
RHW	189	198	207	218	229	240	11
RK1	17	18	19	20	21	23	8
RK2	22	24	25	27	29	31	9
RK3	7	7	8	8	8	9	10
RK4	/	/	/	/	/	/	
RL1	19	20	21	23	24	26	8
RL2	23	25	26	28	31	33	9
RL3	21	22	23	25	26	28	10
RL4	/	/	/	/	/	/	
ROT	18	18	18	18	18	18	11
RRF	75	80	85	91	97	103	11
TAD	192	223	257	293	329	370	1
TAI	49	58	68	79	90	102	1
TRB (10^9Vkm)	0	0	1	1	1	1	2
TRC (10^9Vkm)	7	9	10	11	12	13	1
TRE (10^9Vkm)	2	2	2	2	2	2	2
TRH (10^9Vkm)	18	20	22	24	26	28	1
TRL (10^9Vkm)	116	126	135	144	152	159	3
TRM (10^9Vkm)	5	5	6	6	7	8	1
TRT (10^9Vkm)	240	261	281	299	315	330	3
TRW (10^9Vkm)	4	5	5	5	5	5	2
TTF	69	72	76	79	82	85	1
TTP	11	11	11	11	11	12	2
TWD	88	92	97	101	105	108	1
TWI	81	84	88	92	95	99	1

Table B 19. Energy service demand in CHI

Segment (PJ)	2000	2005	2010	2015	2020	2025	Driver
AGR	1468	1531	1588	1643	1697	1747	1
CC1	6	6	7	7	7	7	1
CC2	115	152	194	245	306	373	1
CC3	/	/	/	/	/	/	
CC4	/	/	/	/	/	/	
CCK	72	81	88	95	100	104	3
CH1	63	66	69	71	73	75	1
CH2	249	279	305	326	342	352	1
CH3	/	/	/	/	/	/	
CH4	/	/	/	/	/	/	
CHW	119	135	149	162	172	180	1
CLA	275	375	494	639	820	1024	1
COE	40	74	129	219	365	568	1
COT	0	0	0	0	0	0	1
CRF	53	59	65	70	74	77	3
ICH	3447	4660	6202	8081	10534	13427	1
IIS (Mt)	116	126	135	144	154	163	1
ILP (Mt)	32	48	67	91	121	156	1
INF (Mt)	2	3	5	7	9	12	1
INM (Mt)	536	817	1177	1581	2045	2510	1
IOI	3977	5684	7789	10482	13988	18074	1
NEU	0	0	0	0	0	0	3
ONO	406	580	795	1070	1427	1844	1
RC1	38	42	46	50	53	55	3
RC2	150	218	299	399	526	663	3
RC3	/	/	/	/	/	/	
RC4	/	/	/	/	/	/	
RCD	1	1	1	1	1	1	3
RCW	19	25	33	41	51	63	3
RDW	1	1	1	2	2	3	3
REA	161	282	452	645	888	1166	3
RH1	979	990	999	1007	1012	1016	2
RH2	903	1005	1097	1180	1251	1300	3
RH3	/	/	/	/	/	/	
RH4	/	/	/	/	/	/	
RHW	461	514	560	603	639	664	3
RK1	5078	5133	5182	5224	5251	5270	2
RK2	818	864	911	958	996	1033	2
RK3	/	/	/	/	/	/	
RK4	/	/	/	/	/	/	
RL1	126	132	137	142	147	150	2
RL2	172	251	345	460	605	763	3
RL3	/	/	/	/	/	/	
RL4	/	/	/	/	/	/	
ROT	0	0	0	0	0	0	3
RRF	141	157	172	185	196	204	3
TAD	236	352	500	698	950	1235	3
TAI	20	34	56	84	122	167	3
TRB (10^9Vkm)	12	16	20	24	29	33	1
TRC (10^9Vkm)	8	12	16	21	27	34	1
TRE (10^9Vkm)	3	3	3	3	3	3	2
TRH (10^9Vkm)	12	17	22	29	37	44	1
TRL (10^9Vkm)	151	203	262	334	414	490	3
TRM (10^9Vkm)	9	12	17	22	28	35	1
TRT (10^9Vkm)	252	338	437	557	691	817	3
TRW (10^9Vkm)	36	38	40	42	43	44	2
TTF	565	711	869	1049	1260	1481	1
TTP	91	95	98	101	104	106	2
TWD	362	425	488	555	629	703	1
TWI	250	282	313	346	380	414	1

Table B 20. Energy service demand in CSA

Segment (PJ)	2000	2005	2010	2015	2020	2025	Driver
AGR	625	672	709	763	805	843	1
CC1	346	379	482	617	790	1000	1
CC2	/	/	/	/	/	/	
CC3	/	/	/	/	/	/	
CC4	/	/	/	/	/	/	
CCK	89	89	93	96	100	103	3
CH1	48	50	53	56	59	61	1
CH2	/	/	/	/	/	/	
CH3	/	/	/	/	/	/	
CH4	/	/	/	/	/	/	
CHW	109	112	119	126	132	137	1
CLA	965	1004	1117	1247	1399	1576	1
COE	97	109	149	204	281	388	1
COT	0	0	0	0	0	0	1
CRF	139	140	146	151	157	161	3
ICH	1571	1659	1970	2427	3071	3972	1
IIS (Mt)	36	39	41	43	44	46	1
ILP (Mt)	10	11	14	17	22	28	1
INF (Mt)	2	3	3	4	5	7	1
INM (Mt)	77	85	114	156	217	306	1
IOI	3220	3640	4426	5418	6682	8309	1
NEU	0	0	0	0	1	1	1
ONO	125	135	166	205	255	319	1
RC1	365	457	557	644	719	797	4
RC2	/	/	/	/	/	/	
RC3	/	/	/	/	/	/	
RC4	/	/	/	/	/	/	
RCD	1	1	1	1	1	2	3
RCW	1	1	1	1	1	2	3
RDW	1	1	1	1	1	2	3
REA	267	271	391	549	746	1015	3
RH1	37	41	46	50	55	59	4
RH2	/	/	/	/	/	/	
RH3	/	/	/	/	/	/	
RH4	/	/	/	/	/	/	
RHW	543	625	714	810	895	981	4
RK1	1580	1720	1854	1980	2093	2205	2
RK2	/	/	/	/	/	/	
RK3	/	/	/	/	/	/	
RK4	/	/	/	/	/	/	
RL1	290	292	342	403	478	569	3
RL2	/	/	/	/	/	/	
RL3	/	/	/	/	/	/	
RL4	/	/	/	/	/	/	
ROT	0	0	0	0	0	0	3
RRF	177	204	232	260	285	311	4
TAD	159	161	209	269	332	395	3
TAI	123	124	160	207	255	304	3
TRB (10^9Vkm)	62	67	72	76	80	84	2
TRC (10^9Vkm)	39	42	51	61	74	90	1
TRE (10^9Vkm)	3	3	3	3	4	4	3
TRH (10^9Vkm)	40	44	53	64	77	94	1
TRL (10^9Vkm)	118	119	154	199	245	291	3
TRM (10^9Vkm)	71	76	93	112	136	165	1
TRT (10^9Vkm)	290	293	379	490	604	718	3
TRW (10^9Vkm)	15	15	17	19	21	23	3
TTF	19	20	22	24	26	29	1
TTP	12	13	13	14	15	16	2
TWD	115	118	129	141	155	170	1
TWI	477	493	537	587	644	709	1

Table B 21. Energy service demand in EEU

Segment (PJ)	2000	2005	2010	2015	2020	2025	Driver
AGR	436	463	492	520	545	563	1
CC1	9	9	10	11	12	13	1
CC2	/	/	/	/	/	/	
CC3	/	/	/	/	/	/	
CC4	/	/	/	/	/	/	
CCK	42	44	47	50	52	54	1
CH1	307	326	346	368	390	413	1
CH2	/	/	/	/	/	/	
CH3	/	/	/	/	/	/	
CH4	/	/	/	/	/	/	
CHW	85	90	96	101	108	114	1
CLA	468	497	528	561	595	630	1
COE	38	47	60	77	98	121	1
COT	5	5	6	6	6	7	1
CRF	30	32	34	36	38	40	1
ICH	827	997	1200	1419	1655	1878	1
IIS (Mt)	30	33	37	41	46	51	1
ILP (Mt)	5	6	7	7	8	9	1
INF (Mt)	1	1	1	1	1	1	1
INM (Mt)	40	46	54	64	75	88	1
IOI	968	1187	1482	1855	2339	2917	1
NEU	19	22	27	33	39	47	1
ONO	165	202	253	316	399	498	1
RC1	27	28	29	31	32	34	3
RC2	/	/	/	/	/	/	
RC3	/	/	/	/	/	/	
RC4	/	/	/	/	/	/	
RCD	38	40	43	45	47	49	3
RCW	9	9	10	11	11	12	3
RDW	4	5	5	5	6	6	3
REA	147	210	302	405	534	689	3
RH1	1310	1338	1370	1403	1438	1473	3
RH2	/	/	/	/	/	/	
RH3	/	/	/	/	/	/	
RH4	/	/	/	/	/	/	
RHW	193	206	220	234	249	265	3
RK1	149	153	156	160	164	168	3
RK2	/	/	/	/	/	/	
RK3	/	/	/	/	/	/	
RK4	/	/	/	/	/	/	
RL1	68	72	77	82	88	93	3
RL2	/	/	/	/	/	/	
RL3	/	/	/	/	/	/	
RL4	/	/	/	/	/	/	
ROT	0	0	0	0	0	0	3
RRF	67	71	76	81	85	88	3
TAD	9	12	17	22	30	39	1
TAI	44	59	80	111	158	218	1
TRB (10^9Vkm)	7	7	8	8	9	9	3
TRC (10^9Vkm)	16	19	24	29	34	41	1
TRE (10^9Vkm)	1	1	1	1	1	1	1
TRH (10^9Vkm)	12	15	18	22	26	31	1
TRL (10^9Vkm)	37	44	53	64	76	88	1
TRM (10^9Vkm)	12	14	17	21	25	30	1
TRT (10^9Vkm)	87	104	125	150	179	207	1
TRW (10^9Vkm)	4	4	4	4	4	4	3
TTF	39	44	50	58	67	76	1
TTP	38	39	40	41	42	43	3
TWD	19	20	22	24	27	29	1
TWI	44	49	54	60	67	75	1

Table B 22. Energy service demand in FSU

Segment (PJ)	2000	2005	2010	2015	2020	2025	Driver
AGR	1182	1271	1357	1426	1477	1517	1
CC1	14	16	17	18	20	21	1
CC2	/	/	/	/	/	/	
CC3	/	/	/	/	/	/	
CC4	/	/	/	/	/	/	
CCK	95	102	109	114	118	121	1
CH1	1075	1155	1233	1301	1362	1425	1
CH2	/	/	/	/	/	/	
CH3	/	/	/	/	/	/	
CH4	/	/	/	/	/	/	
CHW	171	184	196	207	217	227	1
CLA	764	878	1006	1129	1251	1384	1
COE	62	86	125	165	201	237	1
COT	6	7	7	8	8	8	1
CRF	49	54	59	64	68	73	1
ICH	3727	4700	5269	5806	6330	6891	1
IIS (Mt)	70	89	100	110	120	130	1
ILP (Mt)	4	5	6	6	7	8	1
INF (Mt)	3	4	5	5	6	6	1
INM (Mt)	42	53	63	72	82	93	1
IOI	5645	7119	8411	9696	11010	12473	1
NEU	2	2	3	3	3	4	1
ONO	1205	1235	1265	1291	1314	1338	1
RC1	63	69	76	83	89	96	3
RC2	/	/	/	/	/	/	
RC3	/	/	/	/	/	/	
RC4	/	/	/	/	/	/	
RCD	115	124	133	140	146	150	3
RCW	48	52	56	59	62	65	3
RDW	10	10	11	12	12	12	1
REA	240	317	427	537	641	749	3
RH1	5760	6226	6674	7032	7302	7507	3
RH2	/	/	/	/	/	/	
RH3	/	/	/	/	/	/	
RH4	/	/	/	/	/	/	
RHW	558	603	647	684	718	753	3
RK1	533	573	612	643	666	684	1
RK2	/	/	/	/	/	/	
RK3	/	/	/	/	/	/	
RK4	/	/	/	/	/	/	
RL1	146	161	176	191	204	219	1
RL2	/	/	/	/	/	/	
RL3	/	/	/	/	/	/	
RL4	/	/	/	/	/	/	
ROT	0	0	0	0	0	0	1
RRF	192	207	222	235	247	259	3
TAD	23	32	45	60	76	95	3
TAI	556	796	1123	1485	1883	2343	3
TRB (10^9Vkm)	11	14	18	22	25	29	3
TRC (10^9Vkm)	17	21	26	31	37	44	1
TRE (10^9Vkm)	6	6	6	6	7	7	1
TRH (10^9Vkm)	15	19	24	28	34	39	1
TRL (10^9Vkm)	152	192	240	286	332	382	3
TRM (10^9Vkm)	15	19	23	28	33	39	1
TRT (10^9Vkm)	206	262	326	389	452	520	3
TRW (10^9Vkm)	10	10	10	10	10	10	2
TTF	240	284	332	376	417	458	1
TTP	200	216	232	247	262	276	3
TWD	51	56	62	67	71	76	1
TWI	27	30	33	36	38	41	1

Table B 23. Energy service demand in IND

Segment (PJ)	2000	2005	2010	2015	2020	2025	Driver
AGR	567	583	601	619	637	654	1
CC1	2	3	3	3	3	3	1
CC2	47	64	86	117	156	202	1
CC3	/	/	/	/	/	/	
CC4	/	/	/	/	/	/	
CCK	8	9	9	10	10	10	3
CH1	0	0	0	0	0	0	1
CH2	2	3	3	3	4	4	1
CH3	/	/	/	/	/	/	
CH4	/	/	/	/	/	/	
CHW	30	32	35	38	40	42	1
CLA	268	300	336	375	419	465	1
COE	16	24	37	56	81	115	1
COT	15	16	17	19	20	21	1
CRF	8	9	9	10	10	10	3
ICH	1258	1528	1908	2383	2967	3663	1
IIS (Mt)	19	19	20	21	23	24	1
ILP (Mt)	3	4	6	8	10	13	1
INF (Mt)	1	1	1	2	2	3	1
INM (Mt)	88	78	102	132	170	217	1
IOI	1094	1088	1414	1830	2362	3017	1
NEU	0	0	0	0	0	0	1
ONO	29	30	32	34	36	38	1
RC1	5	6	6	6	7	7	4
RC2	100	118	138	161	184	207	5
RC3	/	/	/	/	/	/	
RC4	/	/	/	/	/	/	
RCD	2	2	2	3	3	3	6
RCW	11	12	14	15	17	19	6
RDW	2	2	2	3	3	3	6
REA	70	87	109	135	168	206	3
RH1	63	68	72	76	79	82	4
RH2	61	70	80	91	102	115	5
RH3	/	/	/	/	/	/	
RH4	/	/	/	/	/	/	
RHW	969	1066	1181	1313	1464	1630	3
RK1	3134	3315	3484	3641	3785	3913	4
RK2	1340	1494	1654	1821	1994	2171	5
RK3	/	/	/	/	/	/	
RK4	/	/	/	/	/	/	
RL1	115	124	132	140	147	153	4
RL2	197	234	272	312	353	395	5
RL3	/	/	/	/	/	/	
RL4	/	/	/	/	/	/	
ROT	0	0	0	0	0	0	6
RRF	53	60	69	77	86	95	6
TAD	2	3	4	5	7	10	3
TAI	103	135	182	251	355	492	3
TRB (10^9Vkm)	15	18	22	26	31	38	3
TRC (10^9Vkm)	22	31	43	59	80	105	1
TRE (10^9Vkm)	0	1	1	1	1	1	2
TRH (10^9Vkm)	18	25	35	48	64	85	1
TRL (10^9Vkm)	54	70	94	130	184	255	3
TRM (10^9Vkm)	36	50	70	96	130	172	1
TRT (10^9Vkm)	79	104	140	193	273	378	3
TRW (10^9Vkm)	3	3	3	3	3	3	2
TTF	40	47	55	65	77	89	1
TTP	62	67	72	76	79	83	2
TWD	26	29	33	37	41	45	1
TWI	4	4	4	5	5	6	1

Table B 24. Energy service demand in JPN

Segment (PJ)	2000	2005	2010	2015	2020	2025	Driver
AGR	428	439	453	465	476	486	1
CC1	352	364	380	394	408	422	1
CC2	/	/	/	/	/	/	
CC3	/	/	/	/	/	/	
CC4	/	/	/	/	/	/	
CCK	114	117	121	124	126	128	3
CH1	381	392	404	414	421	426	1
CH2	/	/	/	/	/	/	
CH3	/	/	/	/	/	/	
CH4	/	/	/	/	/	/	
CHW	255	262	270	276	281	285	1
CLA	1260	1296	1335	1368	1392	1409	1
COE	354	401	482	547	607	668	1
COT	89	92	94	97	98	100	1
CRF	89	91	94	97	98	100	3
ICH	1877	2004	2213	2416	2613	2813	1
IIS (Mt)	94	92	91	90	91	90	1
ILP (Mt)	30	30	34	37	40	43	1
INF (Mt)	1	1	2	2	2	2	1
INM (Mt)	81	77	80	84	87	90	1
IOI	2359	2503	2775	3043	3311	3590	1
NEU	11	11	12	14	15	16	1
ONO	0	0	0	0	1	1	1
RC1	561	599	636	671	705	737	4
RC2	/	/	/	/	/	/	
RC3	/	/	/	/	/	/	
RC4	/	/	/	/	/	/	
RCD	28	29	31	33	34	36	4
RCW	11	11	12	13	13	14	4
RDW	11	11	12	13	13	14	4
REA	232	257	307	351	396	442	3
RH1	749	789	828	868	908	947	4
RH2	/	/	/	/	/	/	
RH3	/	/	/	/	/	/	
RH4	/	/	/	/	/	/	
RHW	468	488	507	526	545	564	4
RK1	194	205	215	225	236	246	4
RK2	/	/	/	/	/	/	
RK3	/	/	/	/	/	/	
RK4	/	/	/	/	/	/	
RL1	393	415	437	459	481	503	4
RL2	/	/	/	/	/	/	
RL3	/	/	/	/	/	/	
RL4	/	/	/	/	/	/	
ROT	0	0	0	0	0	0	4
RRF	180	190	200	210	221	231	4
TAD	157	172	202	231	260	288	1
TAI	265	286	326	367	406	446	1
TRB (10^9Vkm)	4	4	4	4	4	4	2
TRC (10^9Vkm)	55	57	62	66	69	72	1
TRE (10^9Vkm)	4	4	4	4	4	4	2
TRH (10^9Vkm)	3	3	3	3	4	4	1
TRL (10^9Vkm)	145	153	168	183	196	207	1
TRM (10^9Vkm)	13	14	16	17	18	19	1
TRT (10^9Vkm)	520	544	585	621	654	685	1
TRW (10^9Vkm)	7	7	7	7	7	7	2
TTF	6	6	6	7	7	7	1
TTP	97	100	104	108	112	116	1
TWD	107	109	113	116	119	122	1
TWI	65	66	68	70	72	74	1

Table B 25. Energy service demand in MEA

Segment (PJ)	2000	2005	2010	2015	2020	2025	Driver
AGR	322	357	423	491	565	643	1
CC1	13	16	21	28	36	45	1
CC2	/	/	/	/	/	/	
CC3	/	/	/	/	/	/	
CC4	/	/	/	/	/	/	
CCK	14	16	18	20	22	24	2
CH1	250	266	295	325	355	387	1
CH2	/	/	/	/	/	/	
CH3	/	/	/	/	/	/	
CH4	/	/	/	/	/	/	
CHW	59	70	95	125	161	205	1
CLA	439	523	707	934	1207	1529	1
COE	125	150	209	280	365	462	1
COT	14	14	15	16	16	17	1
CRF	4	4	5	6	6	7	3
ICH	1691	1849	2173	2508	2867	3246	1
IIS (Mt)	26	27	27	27	27	28	1
ILP (Mt)	2	2	3	3	4	4	1
INF (Mt)	1	1	1	1	2	2	1
INM (Mt)	49	56	73	93	117	144	1
IOI	2676	3107	4026	5116	6411	7918	1
NEU	10	11	13	15	16	18	1
ONO	1702	1744	1820	1893	1965	2035	1
RC1	347	353	398	442	486	526	3
RC2	/	/	/	/	/	/	
RC3	/	/	/	/	/	/	
RC4	/	/	/	/	/	/	
RCD	36	36	41	45	49	53	3
RCW	1	1	1	1	1	1	3
RDW	1	1	1	1	1	1	2
REA	243	248	296	342	389	434	3
RH1	241	267	294	324	354	387	2
RH2	/	/	/	/	/	/	
RH3	/	/	/	/	/	/	
RH4	/	/	/	/	/	/	
RHW	619	633	753	870	991	1107	3
RK1	761	860	961	1067	1173	1281	2
RK2	/	/	/	/	/	/	
RK3	/	/	/	/	/	/	
RK4	/	/	/	/	/	/	
RL1	208	213	253	292	333	372	3
RL2	/	/	/	/	/	/	
RL3	/	/	/	/	/	/	
RL4	/	/	/	/	/	/	
ROT	0	0	0	0	0	0	2
RRF	184	188	224	259	295	329	3
TAD	43	48	60	72	85	98	3
TAI	334	372	463	555	656	759	3
TRB (10^9Vkm)	20	24	26	29	31	34	2
TRC (10^9Vkm)	67	85	115	150	190	234	1
TRE (10^9Vkm)	5	6	6	7	7	8	2
TRH (10^9Vkm)	18	22	30	40	50	62	1
TRL (10^9Vkm)	146	163	202	243	287	332	3
TRM (10^9Vkm)	41	52	71	92	117	144	1
TRT (10^9Vkm)	242	270	335	403	476	551	3
TRW (10^9Vkm)	11	14	15	16	18	20	2
TTF	6	7	8	9	10	11	1
TTP	4	5	5	6	6	7	2
TWD	8	9	10	10	11	12	1
TWI	156	188	227	268	311	358	1

Table B 26. Energy service demand in MEX

Segment (PJ)	2000	2005	2010	2015	2020	2025	Driver
AGR	118	129	151	177	201	226	1
CC1	40	54	91	154	235	347	1
CC2	/	/	/	/	/	/	
CC3	/	/	/	/	/	/	
CC4	/	/	/	/	/	/	
CCK	70	73	80	89	97	104	3
CH1	18	19	22	25	27	30	1
CH2	/	/	/	/	/	/	
CH3	/	/	/	/	/	/	
CH4	/	/	/	/	/	/	
CHW	15	16	17	19	20	20	1
CLA	87	95	111	130	147	165	1
COE	14	19	32	53	82	121	1
COT	0	0	0	0	0	0	1
CRF	18	19	21	23	25	27	3
ICH	499	590	789	1064	1346	1681	1
IIS (Mt)	11	12	14	17	19	22	1
ILP (Mt)	4	4	6	7	8	9	1
INF (Mt)	0	0	0	1	1	1	1
INM (Mt)	31	34	40	48	55	63	1
IOI	588	706	968	1339	1729	2203	1
NEU	0	0	0	0	0	0	1
ONO	0	0	0	0	0	0	1
RC1	67	73	89	110	129	150	3
RC2	/	/	/	/	/	/	
RC3	/	/	/	/	/	/	
RC4	/	/	/	/	/	/	
RCD	0	0	0	0	0	0	3
RCW	0	0	0	0	0	0	3
RDW	0	0	0	0	0	0	3
REA	46	56	84	131	185	253	3
RH1	4	4	5	5	5	6	2
RH2	/	/	/	/	/	/	
RH3	/	/	/	/	/	/	
RH4	/	/	/	/	/	/	
RHW	123	132	140	148	155	163	2
RK1	68	69	73	77	80	83	3
RK2	133	140	158	179	198	217	
RK3	/	/	/	/	/	/	
RK4	/	/	/	/	/	/	
RL1	5	6	6	7	7	8	3
RL2	28	30	34	38	42	46	
RL3	/	/	/	/	/	/	
RL4	/	/	/	/	/	/	
ROT	0	0	0	0	0	0	3
RRF	35	38	45	54	63	72	3
TAD	19	23	33	48	61	77	3
TAI	105	129	185	270	348	435	3
TRB (10^9Vkm)	20	21	22	24	25	26	2
TRC (10^9Vkm)	15	18	26	38	50	64	1
TRE (10^9Vkm)	1	1	2	2	2	2	2
TRH (10^9Vkm)	9	11	16	23	30	39	1
TRL (10^9Vkm)	54	66	94	137	177	221	3
TRM (10^9Vkm)	26	32	45	66	87	112	1
TRT (10^9Vkm)	119	146	210	306	395	493	3
TRW (10^9Vkm)	6	7	7	7	8	8	2
TTF	18	20	24	30	34	39	1
TTP	8	8	9	9	9	9	2
TWD	0	0	0	0	0	0	1
TWI	36	39	44	50	55	61	1

Table B 27. Energy service demand in ODA

Segment (PJ)	2000	2005	2010	2015	2020	2025	Driver
AGR	334	362	392	418	441	462	1
CC1	206	240	298	361	425	490	1
CC2	/	/	/	/	/	/	
CC3	/	/	/	/	/	/	
CC4	/	/	/	/	/	/	
CCK	36	39	43	47	51	54	3
CH1	112	119	128	136	142	146	1
CH2	/	/	/	/	/	/	
CH3	/	/	/	/	/	/	
CH4	/	/	/	/	/	/	
CHW	99	110	121	131	141	151	2
CLA	466	512	584	656	725	791	1
COE	120	167	261	390	554	743	1
COT	3	3	3	3	3	3	1
CRF	109	112	118	122	126	128	3
ICH	1234	1495	1958	2508	3077	3638	1
IIS (Mt)	14	15	18	20	22	24	1
ILP (Mt)	10	12	15	20	28	37	1
INF (Mt)	0	0	0	0	0	0	1
INM (Mt)	43	51	63	75	87	98	1
IOI	4191	5021	6697	8354	10120	11941	1
NEU	0	0	0	0	0	0	1
ONO	262	314	403	502	609	718	1
RC1	156	187	257	340	434	523	3
RC2	/	/	/	/	/	/	
RC3	/	/	/	/	/	/	
RC4	/	/	/	/	/	/	
RCD	6	8	9	10	10	11	2
RCW	19	23	26	29	31	34	2
RDW	6	7	8	8	9	10	2
REA	130	155	209	256	301	340	3
RH1	495	539	583	626	666	708	2
RH2	/	/	/	/	/	/	
RH3	/	/	/	/	/	/	
RH4	/	/	/	/	/	/	
RHW	734	813	888	960	1025	1090	2
RK1	3165	3449	3727	4000	4259	4529	2
RK2	/	/	/	/	/	/	
RK3	/	/	/	/	/	/	
RK4	/	/	/	/	/	/	
RL1	440	492	598	704	806	894	3
RL2	/	/	/	/	/	/	
RL3	/	/	/	/	/	/	
RL4	/	/	/	/	/	/	
ROT	34	35	36	36	37	37	2
RRF	65	72	78	85	91	96	2
TAD	26	30	40	50	63	75	3
TAI	712	931	1352	1918	2647	3454	1
TRB (10^9Vkm)	45	49	53	57	61	65	2
TRC (10^9Vkm)	36	47	69	94	122	150	1
TRE (10^9Vkm)	2	2	3	3	3	3	2
TRH (10^9Vkm)	56	70	96	127	159	191	1
TRL (10^9Vkm)	127	152	208	272	332	375	3
TRM (10^9Vkm)	54	70	102	140	182	224	1
TRT (10^9Vkm)	202	241	332	434	529	598	3
TRW (10^9Vkm)	21	23	25	26	28	30	2
TTF	18	20	21	23	24	25	1
TTP	8	9	10	11	11	12	2
TWD	125	141	167	194	221	246	1
TWI	970	1161	1473	1801	2123	2447	1

Table B 28. Energy service demand in SKO

Segment (PJ)	2000	2005	2010	2015	2020	2025	Driver
AGR	149	169	185	195	204	211	1
CC1	123	135	147	155	160	163	1
CC2	/	/	/	/	/	/	
CC3	/	/	/	/	/	/	
CC4	/	/	/	/	/	/	
CCK	33	35	38	40	41	42	3
CH1	258	282	307	323	334	341	1
CH2	/	/	/	/	/	/	
CH3	/	/	/	/	/	/	
CH4	/	/	/	/	/	/	
CHW	155	169	184	194	200	205	1
CLA	353	386	419	442	456	466	1
COE	54	74	100	123	145	166	1
COT	0	0	0	0	0	0	1
CRF	24	26	28	30	31	31	3
ICH	1237	1653	2212	2753	3239	3710	1
IIS (Mt)	40	45	52	59	64	68	1
ILP (Mt)	8	9	12	15	19	23	3
INF (Mt)	16	19	27	35	42	49	1
INM (Mt)	47	60	76	88	99	109	1
IOI	604	851	1192	1525	1850	2194	1
NEU	18	21	25	29	31	34	1
ONO	191	203	216	225	233	239	1
RC1	57	76	101	124	145	164	3
RC2	/	/	/	/	/	/	
RC3	/	/	/	/	/	/	
RC4	/	/	/	/	/	/	
RCD	5	6	9	11	12	14	3
RCW	3	3	3	3	3	4	2
RDW	1	2	2	2	2	2	3
REA	59	84	120	157	193	229	3
RH1	149	166	184	198	209	220	3
RH2	/	/	/	/	/	/	
RH3	/	/	/	/	/	/	
RH4	/	/	/	/	/	/	
RHW	75	83	92	100	105	111	3
RK1	101	112	124	133	141	148	3
RK2	/	/	/	/	/	/	
RK3	/	/	/	/	/	/	
RK4	/	/	/	/	/	/	
RL1	70	72	74	75	77	78	2
RL2	/	/	/	/	/	/	
RL3	/	/	/	/	/	/	
RL4	/	/	/	/	/	/	
ROT	0	0	0	0	0	0	2
RRF	18	18	19	19	20	20	2
TAD	125	176	246	315	377	439	1
TAI	29	44	65	86	106	125	1
TRB (10^9Vkm)	6	6	6	7	7	7	2
TRC (10^9Vkm)	11	14	17	19	21	23	1
TRE (10^9Vkm)	1	1	1	1	1	1	2
TRH (10^9Vkm)	9	11	13	15	17	18	1
TRL (10^9Vkm)	39	47	56	62	68	73	3
TRM (10^9Vkm)	7	9	11	12	13	14	1
TRT (10^9Vkm)	73	88	104	117	128	136	3
TRW (10^9Vkm)	4	4	4	4	5	5	2
TTF	14	16	19	21	22	24	1
TTP	5	5	5	5	5	5	2
TWD	166	182	199	211	222	231	1
TWI	242	257	273	285	294	303	1

Table B 29. Energy service demand in USA

Segment (PJ)	2000	2005	2010	2015	2020	2025	Driver
AGR	782	824	869	907	943	980	1
CC1	380	407	430	454	460	466	4
CC2	1285	1494	1684	1875	2049	2213	5
CC3	447	494	517	542	570	595	6
CC4	417	489	559	642	728	814	7
CCK	343	365	383	402	419	435	8
CH1	569	601	628	656	664	672	4
CH2	547	617	679	740	797	855	5
CH3	713	773	801	832	867	901	6
CH4	420	476	530	592	658	728	7
CHW	902	962	1010	1058	1102	1147	8
CLA	7025	7807	8447	9123	9755	10409	8
COE	558	669	864	1093	1350	1653	1
COT	685	761	823	889	951	1015	8
CRF	237	253	266	278	290	302	8
ICH	5501	6804	8357	9724	11110	12606	1
IIS (Mt)	99	99	112	125	139	154	1
ILP (Mt)	86	92	104	116	128	140	1
INF (Mt)	7	8	9	11	13	15	1
INM (Mt)	84	91	100	109	118	126	1
IOI	8157	9356	11138	12958	14894	17097	1
NEU	204	229	269	310	349	394	1
ONO	0	0	0	0	0	0	1
RC1	114	115	117	119	121	123	9
RC2	1229	1316	1407	1495	1584	1673	10
RC3	291	303	315	326	339	351	11
RC4	122	129	136	144	152	160	12
RCD	301	316	332	348	364	381	13
RCW	32	33	35	36	38	40	13
RDW	23	24	25	26	27	29	13
REA	1366	1533	1864	2220	2586	2998	3
RH1	1117	1132	1149	1167	1186	1205	9
RH2	959	1020	1084	1145	1206	1267	10
RH3	1391	1438	1487	1534	1583	1630	11
RH4	651	679	709	739	771	802	12
RHW	1440	1494	1550	1605	1661	1717	13
RK1	349	366	383	400	418	436	13
RK2	/	/	/	/	/	/	2
RK3	/	/	/	/	/	/	
RK4	/	/	/	/	/	/	
RL1	486	511	536	562	588	614	13
RL2	/	/	/	/	/	/	13
RL3	/	/	/	/	/	/	
RL4	/	/	/	/	/	/	
ROT	132	133	133	134	135	135	13
RRF	583	612	643	673	705	736	13
TAD	2950	3355	4018	4737	5511	6403	1
TAI	872	997	1201	1424	1665	1945	1
TRB (10^9Vkm)	19	20	20	21	21	22	2
TRC (10^9Vkm)	110	128	158	192	227	266	1
TRE (10^9Vkm)	6	6	6	6	6	6	2
TRH (10^9Vkm)	224	243	271	301	330	362	1
TRL (10^9Vkm)	1554	1732	2017	2318	2598	2871	1
TRM (10^9Vkm)	60	68	80	93	107	123	1
TRT (10^9Vkm)	2352	2576	2906	3219	3511	3801	1
TRW (10^9Vkm)	8	8	9	9	9	10	2
TTF	486	541	630	724	812	897	1
TTP	80	84	88	91	95	99	2
TWD	337	358	391	423	455	490	1
TWI	1236	1315	1435	1554	1672	1797	1

Table B 30. Energy service demand in WEU

Segment (PJ)	2000	2005	2010	2015	2020	2025	Driver
AGR	1048	1072	1100	1127	1154	1180	1
CC1	1217	1287	1368	1452	1540	1628	1
CC2	/	/	/	/	/	/	
CC3	/	/	/	/	/	/	
CC4	/	/	/	/	/	/	
CCK	124	128	133	137	141	143	3
CH1	1380	1427	1478	1523	1560	1586	1
CH2	/	/	/	/	/	/	
CH3	/	/	/	/	/	/	
CH4	/	/	/	/	/	/	
CHW	573	593	614	632	648	659	1
CLA	4078	4311	4585	4865	5162	5454	1
COE	398	489	613	763	949	1154	1
COT	131	132	134	136	137	139	1
CRF	187	194	200	207	212	216	3
ICH	5707	6282	6919	7569	8282	9015	1
IIS (Mt)	123	127	131	135	139	143	1
ILP (Mt)	81	92	105	117	130	143	1
INF (Mt)	5	5	6	7	8	9	1
INM (Mt)	112	126	144	160	176	190	1
IOI	5320	5929	6680	7497	8411	9365	1
NEU	96	100	103	107	111	115	1
ONO	595	663	747	838	941	1047	1
RC1	40	41	42	43	43	44	4
RC2	/	/	/	/	/	/	
RC3	/	/	/	/	/	/	
RC4	/	/	/	/	/	/	
RCD	12	12	13	13	13	13	4
RCW	2	2	2	2	2	2	4
RDW	2	2	2	2	2	2	4
REA	65	79	97	114	133	152	3
RH1	5032	5152	5271	5366	5462	5559	4
RH2	/	/	/	/	/	/	
RH3	/	/	/	/	/	/	
RH4	/	/	/	/	/	/	
RHW	704	720	737	750	764	777	4
RK1	266	272	278	283	288	293	4
RK2	/	/	/	/	/	/	
RK3	/	/	/	/	/	/	
RK4	/	/	/	/	/	/	
RL1	25	25	26	27	27	28	4
RL2	/	/	/	/	/	/	
RL3	/	/	/	/	/	/	
RL4	/	/	/	/	/	/	
ROT	0	0	0	0	0	0	4
RRF	28	29	29	30	30	30	4
TAD	434	471	513	554	595	632	1
TAI	1589	1753	1953	2168	2379	2568	1
TRB (10^9Vkm)	24	24	24	24	24	24	2
TRC (10^9Vkm)	112	120	129	138	149	159	1
TRE (10^9Vkm)	9	9	9	9	9	9	2
TRH (10^9Vkm)	153	164	176	189	203	217	1
TRL (10^9Vkm)	442	452	463	475	486	497	3
TRM (10^9Vkm)	97	104	112	120	129	137	1
TRT (10^9Vkm)	1086	1110	1138	1166	1194	1220	3
TRW (10^9Vkm)	17	17	17	17	17	17	2
TTF	100	105	110	115	121	126	1
TTP	233	234	234	233	232	231	2
TWD	284	294	305	316	328	339	1
TWI	1337	1383	1435	1488	1542	1595	1

Table B 31. Demand drivers for the base case

Region	Driver	No	2000	2005	2010	2015	2020	2025
AFR	GDP (1997 Billions US$)	1	596	715	862	1027	1216	1426
AFR	Population Millions	2	794	892	997	1110	1231	1362
AFR	GDP/Pop	3	1	1	1	1	1	1
AUS	GDP (1997 Billions US$)	1	532	622	728	850	991	1148
AUS	Population Millions	2	27	28	30	31	32	33
AUS	GDP/Pop	3	20	22	25	28	31	35
AUS	Households (Millions)	4	8	9	10	11	12	13
CAN	GDP (1997 Billions US$)	1	731	848	978	1112	1253	1406
CAN	Population Millions	2	31	32	33	34	36	37
CAN	GDP/Pop	3	24	26	29	32	35	38
CAN	Commercial Floorspace Region 1 (Millions m2)	4	199	217	234	251	269	287
CAN	Commercial Floorspace Region 2 (Millions m2)	5	214	240	267	296	324	354
CAN	Commercial Floorspace Region 3 (Millions m2)	6	147	162	176	192	206	221
CAN	Commercial Floorspace Total (Millions m2)	7	561	619	678	739	799	861
CAN	Housing Stock Region 1 (Millions)	8	4	4	4	5	5	5
CAN	Housing Stock Region 2 (Millions)	9	5	5	5	6	6	6
CAN	Housing Stock Region 3 (Millions)	10	4	4	5	5	5	6
CAN	Housing Stock All Regions (Millions)	11	12	13	14	15	16	17
CAN	Heavy Trucks (Billion Kms)	12	23	24	26	28	31	34
CAN	Light Trucks (Billion Kms)	13	110	127	145	164	186	207
CAN	Medium Trucks (Billion Kms)	14	9	10	11	12	12	13
CAN	Passengers cars (Billion Kms)	15	217	226	241	265	293	318
CHI	GDP (1997 Billions US$)	1	1119	1599	2191	2949	3935	5085
CHI	Population Millions	2	1275	1321	1366	1410	1446	1482
CHI	GDP/Pop	3	1	1	2	2	3	3
CHI	Households (Millions)	4	332	356	379	402	424	445
CHI	Housing Stock Rural (Millions)	5	203	211	218	223	229	233
CHI	Housing Stock Urban (Millions)	6	129	145	162	179	196	212
CSA	GDP (1997 Billions US$)	1	1497	1618	1983	2446	3040	3811
CSA	Population Millions	2	416	447	477	507	534	563
CSA	GDP/Pop	3	4	4	4	5	6	7
CSA	Households (Millions)	4	103	116	130	144	157	172
CSA	Population-Rural (Millions)	5	102	102	102	100	99	99
CSA	Population-Urban (Millions)	6	314	344	376	407	435	464
EEU	GDP (1997 Billions US$)	1	380	458	561	689	853	1044
EEU	Population Millions	2	121	120	119	118	116	115
EEU	GDP/Pop	3	3	4	5	6	7	9
FSU	GDP (1997 Billions US$)	1	617	770	957	1152	1360	1600
FSU	Population Millions	2	291	286	283	280	278	275
FSU	GDP/Pop	3	2	3	3	4	5	6
IND	GDP (1997 Billions US$)	1	495	640	832	1077	1390	1775
IND	Population Millions	2	1009	1089	1164	1230	1291	1346
IND	GDP/Pop	3	0	1	1	1	1	1
IND	Housing Stock Rural (Millions)	4	130	139	147	155	162	169
IND	Housing Stock Urban (Millions)	5	54	62	71	81	91	102
IND	Housing Stock Total (Millions)	6	184	201	218	236	253	270
JPN	GDP (1997 Billions US$)	1	4390	4658	5164	5662	6162	6680
JPN	Population Millions	2	127	128	128	128	126	124
JPN	GDP/Pop	3	35	36	40	44	49	54
JPN	Households (Millions)	4	46	49	51	54	56	59
MEA	GDP (1997 Billions US$)	1	590	663	808	970	1154	1359
MEA	Population Millions	2	242	268	295	325	355	388
MEA	GDP/Pop	3	2	2	3	3	3	4
MEX	GDP (1997 Billions US$)	1	453	536	717	967	1223	1528
MEX	Population Millions	2	99	106	113	119	125	131
MEX	GDP/Pop	3	5	5	6	8	10	12
ODA	GDP (1997 Billions US$)	1	1241	1486	1906	2376	2877	3394
ODA	Population Millions	2	919	1001	1082	1161	1236	1315
ODA	GDP/Pop	3	1	1	2	2	2	3
SKO	GDP (1997 Billions US$)	1	539	708	927	1126	1311	1498
SKO	Population Millions	2	47	48	50	51	51	52
SKO	GDP/Pop	3	12	15	19	22	25	29
USA	GDP (1997 Billions US$)	1	9370	10563	12497	14566	16770	19285
USA	Population Millions	2	276	288	300	313	325	338
USA	GDP/Pop	3	34	37	42	47	52	57
USA	Commercial Floorspace Region 1 (Millions f2)	4	12366	13110	13722	14354	14541	14721
USA	Commercial Floorspace Region 2 (Millions f2)	5	23519	26708	29534	32324	34932	37609

Region	Driver	No	2000	2005	2010	2015	2020	2025
USA	Commercial Floorspace Region 3 (Millions f2)	6	15483	16852	17508	18218	19015	19805
USA	Commercial Floorspace Region 4 (Millions f2)	7	13128	15004	16783	18857	21072	23424
USA	Commercial Floorspace Total (Millions f2)	8	64495	71674	77546	83753	89560	95560
USA	Housing Stock Region 1 (Millions)	9	20	20	21	21	21	22
USA	Housing Stock Region 2 (Millions)	10	38	41	43	46	49	52
USA	Housing Stock Region 3 (Millions)	11	25	26	27	28	29	30
USA	Housing Stock Region 4 (Millions)	12	23	24	25	27	28	30
USA	Housing Stock Total (Millions)	13	105	110	116	121	127	133
WEU	GDP (1997 Billions US$)	1	9312	10378	11694	13125	14724	16395
WEU	Population Millions	2	389	391	391	389	387	385
WEU	GDP/Pop	3	24	27	30	34	38	43
WEU	Housing Stock Total (Millions)	4	148	152	155	158	161	164

Table B 32. Gross Domestic Product (GDP) driver for three economic growth cases

Regions	2000	2005	2010	2015	2020	2025
Reference Case (1997 Billions US$)						
AFR	596	715	862	1027	1216	1426
AUS	532	622	728	850	991	1148
CAN	731	848	978	1112	1253	1406
CHI	1119	1599	2191	2949	3935	5085
CSA	1497	1618	1983	2446	3040	3811
EEU	380	458	561	689	853	1044
FSU	617	770	957	1152	1360	1600
IND	495	640	832	1077	1390	1775
JPN	4390	4658	5164	5662	6162	6680
MEA	590	663	808	970	1154	1359
MEX	453	536	717	967	1223	1528
ODA	1241	1486	1906	2376	2877	3394
SKO	539	708	927	1126	1311	1498
USA	9370	10563	12497	14566	16770	19285
WEU	9312	10378	11694	13125	14724	16395
High Growth Case (1997 Billions US$)						
AFR	596	750	949	1186	1473	1813
AUS	532	653	801	983	1202	1461
CAN	731	890	1077	1286	1521	1791
CHI	1119	1675	2405	3392	4744	6427
CSA	645	697	909	1185	1558	2079
EEU	380	515	711	984	1371	1890
FSU	617	867	1212	1643	2186	2900
IND	495	671	914	1241	1679	2249
JPN	4390	4893	5695	6556	7494	8532
MEA	590	696	890	1121	1399	1729
MEX	453	563	788	1114	1478	1936
ODA	1241	1559	2097	2742	3483	4310
SKO	539	742	1018	1298	1586	1902
USA	9370	11089	13766	16838	20347	24558
WEU	9312	10896	12888	15186	17886	20909
Low Growth Case (1997 Billions US$)						
AFR	596	681	782	888	1001	1119
AUS	532	592	660	735	815	900
CAN	731	807	887	961	1030	1100
CHI	1119	1422	1730	2066	2447	2804
CSA	645	631	748	886	1058	1284
EEU	380	436	509	597	703	821
FSU	617	734	869	997	1121	1257
IND	495	610	756	934	1148	1399
JPN	4390	4433	4678	4882	5057	5218
MEA	590	631	733	839	950	1066
MEX	453	511	651	838	1010	1203
ODA	1241	1416	1731	2057	2373	2666
SKO	539	675	843	975	1081	1177
USA	9370	10057	11335	12583	13796	15108
WEU	9312	9880	10600	11327	12098	12824

Table B 33. Share of residential end-uses by fuel in AFR

	RH1	RC1	RHW	RRF	RCD	RK1	RCW	RDW	ROT	REA	RL1	Total
RESNGA	0.40		0.40			0.20						1.00
RESDST	0.50		0.40						0.10			1.00
RESHFO												
RESKER	0.30		0.30			0.20					0.20	1.00
RESCOA	0.70		0.25			0.05						1.00
RESLPG	0.30		0.40			0.30						1.00
RESBIO	0.30		0.35			0.35						1.00
RESELC	0.10	0.10	0.10	0.15	0.01	0.05	0.01	0.01		0.22	0.25	1.00
RESHET												
RESGEO												
RESSOL												

Table B 34. Share of residential end-uses by fuel in AUS

	RH1	RC1	RHW	RRF	RCD	RK1	RCW	RDW	ROT	REA	RL1	Total
RESNGA	0.71		0.28		0.00	0.01						1.00
RESDST	0.85		0.15									1.00
RESHFO												
RESKER	1.00											1.00
RESCOA	0.94		0.06									1.00
RESLPG	0.84		0.16									1.00
RESBIO	1.00											1.00
RESELC	0.25	0.04	0.10	0.13	0.06	0.04	0.02	0.01		0.25	0.10	1.00
RESHET												
RESGEO	1.00											1.00
RESSOL			1.00									1.00

Table B 35. Share of residential end-uses by fuel in CAN

	RH1	RC1	RHW	RRF	RCD	RK1	RCW	RDW	ROT	REA	RL1	Total
RESNGA	0.66	0.00	0.26		0.01	0.04			0.02			1.00
RESDST	0.84		0.16									1.00
RESHFO	1.00											1.00
RESKER	1.00											1.00
RESCOA	1.00											1.00
RESLPG	0.68		0.23			0.07			0.02			1.00
RESBIO	1.00											1.00
RESELC	0.10	0.14	0.10	0.14	0.06	0.03	0.01	0.01		0.33	0.09	1.00
RESHET												
RESGEO	0.87	0.13										1.00
RESSOL			1.00									1.00

Table B 36. Share of residential end-uses by fuel in CHI

	RH1	RC1	RHW	RRF	RCD	RK1	RCW	RDW	ROT	REA	RL1	Total
RESNGA	0.75		0.15			0.10						1.00
RESDST	0.70		0.30									1.00
RESHFO	1.00											1.00
RESKER	0.06					0.25					0.69	1.00
RESCOA	0.60		0.05			0.35						1.00
RESLPG	0.25		0.25			0.50						1.00
RESBIO	0.33		0.12			0.55						1.00
RESELC	0.08	0.10	0.05	0.22	0.00	0.05	0.03	0.00		0.25	0.22	1.00
RESHET	1.00											1.00
RESGEO	1.00											1.00
RESSOL			1.00									1.00

Table B 37. Share of residential end-uses by fuel in CSA

	RH1	RC1	RHW	RRF	RCD	RK1	RCW	RDW	ROT	REA	RL1	Total
RESNGA	0.05		0.60			0.35						1.00
RESDST	0.70		0.30									1.00
RESHFO	1.00											1.00
RESKER	0.03					0.51					0.46	1.00
RESCOA	1.00											1.00
RESLPG			0.60			0.40						1.00
RESBIO	0.01		0.21			0.78						1.00
RESELC	0.01	0.16	0.02	0.23	0.00	0.02	0.00	0.00		0.35	0.21	1.00
RESHET	1.00											1.00
RESGEO	1.00											1.00
RESSOL			1.00									1.00

Table B 38. Share of residential end-uses by fuel in EEU

	RH1	RC1	RHW	RRF	RCD	RK1	RCW	RDW	ROT	REA	RL1	Total
RESNGA	0.70	0.00	0.13		0.05	0.12						1.00
RESDST	0.85		0.15									1.00
RESHFO	1.00											1.00
RESKER	0.90					0.10						1.00
RESCOA	0.85		0.15									1.00
RESLPG	0.65		0.20			0.15						1.00
RESBIO	0.60		0.25			0.15						1.00
RESELC	0.16	0.02	0.15	0.15	0.01	0.03	0.02	0.01		0.33	0.12	1.00
RESHET	1.00											1.00
RESGEO	1.00											1.00
RESSOL												

Table B 39. Share of residential end-uses by fuel in FSU

	RH1	RC1	RHW	RRF	RCD	RK1	RCW	RDW	ROT	REA	RL1	Total
RESNGA	0.72	0.00	0.13		0.03	0.12						1.00
RESDST	0.85		0.15									1.00
RESHFO	1.00											1.00
RESKER	0.90					0.10						1.00
RESCOA	0.85		0.15									1.00
RESLPG	0.65		0.20			0.15						1.00
RESBIO	0.60		0.25			0.15						1.00
RESELC	0.16	0.02	0.15	0.20	0.01	0.03	0.05	0.01		0.25	0.12	1.00
RESHET	1.00											1.00
RESGEO	1.00											1.00
RESSOL			1.00									1.00

Table B 40. Share of residential end-uses by fuel in IND

	RH1	RC1	RHW	RRF	RCD	RK1	RCW	RDW	ROT	REA	RL1	Total
RESNGA	0.10		0.50			0.40						1.00
RESDST	0.50		0.50									1.00
RESHFO	1.00											1.00
RESKER	0.10					0.70					0.20	1.00
RESCOA	0.20		0.30			0.50						1.00
RESLPG			0.05			0.95						1.00
RESBIO	0.01		0.49			0.50						1.00
RESELC	0.05	0.10	0.08	0.15	0.01	0.05	0.03	0.01		0.20	0.33	1.00
RESHET	1.00											1.00
RESGEO												
RESSOL			0.95			0.05						1.00

Table B 41. Share of residential end-uses by fuel in JPN

	RH1	RC1	RHW	RRF	RCD	RK1	RCW	RDW	ROT	REA	RL1	Total
RESNGA	0.30		0.54			0.17						1.00
RESDST	1.00											1.00
RESHFO	1.00											1.00
RESKER	0.71		0.28			0.01						1.00
RESCOA	0.09		0.77			0.14						1.00
RESLPG	0.14		0.69			0.17						1.00
RESBIO	1.00											1.00
RESELC	0.16	0.17	0.04	0.17	0.03	0.05	0.01	0.01		0.22	0.16	1.00
RESHET	1.00											1.00
RESGEO	0.86	0.14										1.00
RESSOL			1.00									1.00

Table B 42. Share of residential end-uses by fuel in MEA

	RH1	RC1	RHW	RRF	RCD	RK1	RCW	RDW	ROT	REA	RL1	Total
RESNGA	0.05		0.65		0.05	0.25						1.00
RESDST	0.70		0.30									1.00
RESHFO	1.00											1.00
RESKER	0.10		0.50			0.30					0.10	1.00
RESCOA	1.00											1.00
RESLPG	0.10		0.50			0.40						1.00
RESBIO	0.01		0.21			0.78						1.00
RESELC	0.01	0.16	0.02	0.25	0.00	0.02	0.00	0.00		0.33	0.21	1.00
RESHET	1.00											1.00
RESGEO	1.00											1.00
RESSOL			1.00									1.00

Table B 43. Share of residential end-uses by fuel in MEX

	RH1	RC1	RHW	RRF	RCD	RK1	RCW	RDW	ROT	REA	RL1	Total
RESNGA	0.05		0.30			0.65						1.00
RESDST	0.70		0.30									1.00
RESHFO	1.00											1.00
RESKER	0.08					0.72					0.20	1.00
RESCOA	1.00											1.00
RESLPG			0.41			0.59						1.00
RESBIO	0.01		0.21			0.78						1.00
RESELC	0.01	0.16	0.02	0.25	0.00	0.02	0.00	0.00		0.33	0.21	1.00
RESHET	1.00											1.00
RESGEO	1.00											1.00
RESSOL			1.00									1.00

Table B 44. Share of residential end-uses by fuel in ODA

	RH1	RC1	RHW	RRF	RCD	RK1	RCW	RDW	ROT	REA	RL1	Total
RESNGA	0.10		0.35			0.40			0.15			1.00
RESDST	0.20		0.50						0.30			1.00
RESHFO	1.00											1.00
RESKER	0.15		0.30			0.40					0.15	1.00
RESCOA	0.50		0.40			0.10						1.00
RESLPG	0.25		0.40			0.35						1.00
RESBIO	0.20		0.30			0.50						1.00
RESELC	0.02	0.08	0.08	0.10	0.01	0.05	0.03	0.01		0.20	0.42	1.00
RESHET	1.00											1.00
RESGEO	1.00											1.00
RESSOL			1.00									1.00

Table B 45. Share of residential end-uses by fuel in SKO

	RH1	RC1	RHW	RRF	RCD	RK1	RCW	RDW	ROT	REA	RL1	Total
RESNGA	0.30		0.40		0.01	0.29						1.00
RESDST	0.70		0.30									1.00
RESHFO	1.00											1.00
RESKER	0.30		0.30			0.40						1.00
RESCOA	1.00											1.00
RESLPG	0.24		0.44			0.32						1.00
RESBIO	0.20		0.20			0.60						1.00
RESELC	0.02	0.13	0.03	0.12	0.02	0.02	0.02	0.01		0.40	0.23	1.00
RESHET	1.00											1.00
RESGEO	1.00											1.00
RESSOL			1.00									1.00

Table B 46. Share of residential end-uses by fuel in USA

	RH1	RC1	RHW	RRF	RCD	RK1	RCW	RDW	ROT	REA	RL1	Total
RESNGA	0.66	0.00	0.26		0.01	0.04			0.02			1.00
RESDST	0.84		0.16									1.00
RESHFO	1.00											1.00
RESKER	1.00											1.00
RESCOA	1.00											1.00
RESLPG	0.68		0.23			0.07			0.02			1.00
RESBIO	1.00											1.00
RESELC	0.10	0.14	0.10	0.14	0.06	0.03	0.01	0.01		0.33	0.09	1.00
RESHET												
RESGEO	0.87	0.13										1.00
RESSOL			1.00									1.00

Table B 47. Share of residential end-uses by fuel in WEU

	RH1	RC1	RHW	RRF	RCD	RK1	RCW	RDW	ROT	REA	RL1	Total
RESNGA	0.79		0.16			0.05						1.00
RESDST	0.86		0.14									1.00
RESHFO	1.00											1.00
RESKER	1.00											1.00
RESCOA	0.90		0.09			0.01						1.00
RESLPG	0.68		0.23			0.09						1.00
RESBIO	0.98		0.02									1.00
RESELC	0.17	0.05	0.10	0.14	0.06	0.05	0.01	0.01		0.32	0.09	1.00
RESHET	1.00											1.00
RESGEO	0.86	0.14										1.00
RESSOL			1.00									1.00

Table B 48. Share of commercial end-uses by fuel in AFR

	CH1	CC1	CHW	CLA	CCK	CRF	COE	COT	Total
COMNGA	0.50	0.01	0.35		0.15				1.00
COMDST	0.60		0.40						1.00
COMHFO	1.00								1.00
COMKER	0.10		0.10	0.60	0.20				1.00
COMCOA	0.80				0.20				1.00
COMLPG	0.50		0.30		0.20				1.00
COMBIO	0.50		0.30		0.20				1.00
COMELC	0.03	0.08	0.10	0.35	0.05	0.23	0.16		1.00
COMHET									
COMGEO									
COMSOL									

Table B 49. Share of commercial end-uses by fuel in AUS

	CH1	CC1	CHW	CLA	CCK	CRF	COE	COT	Total
COMNGA	0.86		0.13		0.01			0.00	1.00
COMDST	0.82		0.17					0.01	1.00
COMHFO	0.85		0.15						1.00
COMKER	1.00								1.00
COMCOA	0.60		0.40						1.00
COMLPG	0.85		0.10		0.05				1.00
COMBIO	1.00								1.00
COMELC	0.12	0.13	0.01	0.32	0.02	0.05	0.35		1.00
COMHET	1.00								1.00
COMGEO									
COMSOL			1.00						1.00

Table B 50. Share of commercial end-uses by fuel in CAN

	CH1	CC1	CHW	CLA	CCK	CRF	COE	COT	Total
COMNGA	0.80		0.14		0.05			0.01	1.00
COMDST	0.80		0.17					0.03	1.00
COMHFO	0.85		0.11					0.04	1.00
COMKER	1.00								1.00
COMCOA									
COMLPG	0.94							0.06	1.00
COMBIO									
COMELC	0.11	0.13	0.03	0.39	0.01	0.05	0.18	0.11	1.00
COMHET	1.00								1.00
COMGEO	0.85	0.15							1.00
COMSOL			1.00						1.00

Table B 51. Share of commercial end-uses by fuel in CHI

	CH1	CC1	CHW	CLA	CCK	CRF	COE	COT	Total
COMNGA	0.90		0.05		0.05				1.00
COMDST	0.70		0.30						1.00
COMHFO	1.00								1.00
COMKER	0.20		0.30	0.35	0.15				1.00
COMCOA	0.60		0.30		0.10				1.00
COMLPG	0.25		0.25		0.50				1.00
COMBIO	0.30		0.35		0.35				1.00
COMELC	0.10	0.15	0.06	0.31	0.03	0.20	0.15		1.00
COMHET	1.00								1.00
COMGEO	1.00								1.00
COMSOL			1.00						1.00

Table B 52. Share of commercial end-uses by fuel in CSA

	CH1	CC1	CHW	CLA	CCK	CRF	COE	COT	Total
COMNGA	0.10		0.80		0.10				1.00
COMDST	0.05		0.95						1.00
COMHFO	1.00								1.00
COMKER	0.05		0.20		0.75				1.00
COMCOA								1.00	1.00
COMLPG	0.01		0.19		0.80				1.00
COMBIO	1.00								1.00
COMELC	0.01	0.19	0.02	0.37	0.02	0.23	0.16		1.00
COMHET			1.00						1.00
COMGEO			1.00						1.00
COMSOL			1.00						1.00

Table B 53. Share of commercial end-uses by fuel in EEU

	CH1	CC1	CHW	CLA	CCK	CRF	COE	COT	Total
COMNGA	0.59	0.00	0.28		0.12			0.01	1.00
COMDST	0.67		0.26					0.07	1.00
COMHFO	1.00								1.00
COMKER	1.00								1.00
COMCOA	1.00								1.00
COMLPG	0.71		0.22		0.07				1.00
COMBIO	1.00								1.00
COMELC	0.11	0.01	0.11	0.49	0.03	0.11	0.14		1.00
COMHET	1.00								1.00
COMGEO	1.00								1.00
COMSOL			1.00						1.00

Table B 54. Share of commercial end-uses by fuel in FSU

	CH1	CC1	CHW	CLA	CCK	CRF	COE	COT	Total
COMNGA	0.59	0.00	0.28		0.12			0.01	1.00
COMDST	0.67		0.26					0.07	1.00
COMHFO	1.00								1.00
COMKER	1.00								1.00
COMCOA	1.00								1.00
COMLPG	0.71		0.22		0.07				1.00
COMBIO	1.00								1.00
COMELC	0.11	0.01	0.11	0.49	0.03	0.11	0.14		1.00
COMHET	1.00								1.00
COMGEO									
COMSOL									

Table B 55. Share of commercial end-uses by fuel in IND

	CH1	CC1	CHW	CLA	CCK	CRF	COE	COT	Total
COMNGA	0.90		0.05		0.05				1.00
COMDST	0.80		0.05					0.15	1.00
COMHFO	1.00								1.00
COMKER	1.00								1.00
COMCOA	0.95		0.05						1.00
COMLPG	0.90		0.10						1.00
COMBIO	1.00								1.00
COMELC	0.01	0.10	0.20	0.40	0.05	0.05	0.10	0.09	1.00
COMHET									
COMGEO									
COMSOL									

Table B 56. Share of commercial end-uses by fuel in JPN

	CH1	CC1	CHW	CLA	CCK	CRF	COE	COT	Total
COMNGA	0.11	0.10	0.39		0.40				1.00
COMDST	0.59	0.03	0.38						1.00
COMHFO	0.60		0.40						1.00
COMKER	0.60		0.40						1.00
COMCOA	0.15		0.62		0.23				1.00
COMLPG	0.60		0.40						1.00
COMBIO	1.00								1.00
COMELC	0.03	0.10		0.35		0.09	0.35	0.09	1.00
COMHET	1.00								1.00
COMGEO	0.86	0.14							1.00
COMSOL			1.00						1.00

Table B 57. Share of commercial end-uses by fuel in MEA

	CH1	CC1	CHW	CLA	CCK	CRF	COE	COT	Total
COMNGA	0.60	0.01	0.20		0.10			0.10	1.00
COMDST	0.70		0.20					0.10	1.00
COMHFO	1.00								1.00
COMKER	0.30		0.40		0.30				1.00
COMCOA									
COMLPG	0.40		0.40		0.20				1.00
COMBIO									
COMELC	0.27	0.01	0.10	0.30	0.01	0.01	0.30		1.00
COMHET									
COMGEO									
COMSOL			1.00						1.00

Table B 58. Share of commercial end-uses by fuel in MEX

	CH1	CC1	CHW	CLA	CCK	CRF	COE	COT	Total
COMNGA	0.10		0.80		0.10				1.00
COMDST	0.05		0.95						1.00
COMHFO	1.00								1.00
COMKER	0.05		0.20		0.75				1.00
COMCOA								1.00	1.00
COMLPG	0.01		0.19		0.80				1.00
COMBIO	1.00								1.00
COMELC	0.01	0.19	0.02	0.32		0.26	0.20		1.00
COMHET			1.00						1.00
COMGEO			1.00						1.00
COMSOL			1.00						1.00

Table B 59. Share of commercial end-uses by fuel in ODA

	CH1	CC1	CHW	CLA	CCK	CRF	COE	COT	Total
COMNGA	0.15		0.40		0.40			0.05	1.00
COMDST	0.50		0.50						1.00
COMHFO	0.70		0.30						1.00
COMKER	0.50		0.40		0.10				1.00
COMCOA	0.60		0.30		0.10				1.00
COMLPG	0.60		0.35		0.05				1.00
COMBIO	0.30		0.30		0.40				1.00
COMELC	0.03	0.13	0.06	0.35	0.01	0.20	0.22		1.00
COMHET	1.00								1.00
COMGEO	1.00								1.00
COMSOL			1.00						1.00

Table B 60. Share of commercial end-uses by fuel in SKO

	CH1	CC1	CHW	CLA	CCK	CRF	COE	COT	Total
COMNGA	0.30	0.05	0.40		0.25				1.00
COMDST	0.59	0.01	0.40						1.00
COMHFO	0.80		0.20						1.00
COMKER	0.60		0.37		0.03				1.00
COMCOA	0.60		0.20		0.20				1.00
COMLPG	0.60		0.35		0.05				1.00
COMBIO	0.30		0.20		0.50				1.00
COMELC	0.03	0.15	0.03	0.46	0.01	0.10	0.22		1.00
COMHET	1.00								1.00
COMGEO	1.00								1.00
COMSOL			1.00						1.00

Table B 61. Share of commercial end-uses by fuel in USA

	CH1	CC1	CHW	CLA	CCK	CRF	COE	COT	Total
COMNGA	0.57	0.01	0.26		0.08			0.08	1.00
COMDST	0.66	0.00	0.27					0.07	1.00
COMHFO	1.00								1.00
COMKER	1.00								1.00
COMCOA	1.00								1.00
COMLPG	0.71		0.22		0.07				1.00
COMBIO	1.00								1.00
COMELC	0.05	0.21	0.05	0.40	0.01	0.06	0.14	0.09	1.00
COMHET	1.00								1.00
COMGEO	0.86	0.14							1.00
COMSOL			1.00						1.00

Table B 62. Share of commercial end-uses by fuel in WEU

	CH1	CC1	CHW	CLA	CCK	CRF	COE	COT	Total
COMNGA	0.57	0.01	0.27		0.09			0.06	1.00
COMDST	0.66	0.00	0.27					0.07	1.00
COMHFO	1.00								1.00
COMKER	1.00								1.00
COMCOA	1.00								1.00
COMLPG	0.71		0.22		0.07				1.00
COMBIO	1.00								1.00
COMELC	0.08	0.17	0.10	0.39	0.01	0.08	0.17		1.00
COMHET	1.00								1.00
COMGEO	0.86	0.14							1.00
COMSOL			1.00						1.00

Table B 63. Share of industrial energy services by fuel in AFR

Fuel	ISIS	ISIS	IPIS	IMIS	IEIS	IOIS	Total	ISNF	ISNF	IPNF	IMNF	IENF	IONF	Total
INDELC			0.10	0.88		0.02	1.00			0.47	0.35	0.15	0.03	1.00
INDNGA	0.07		0.82			0.11	1.00	0.11		0.86			0.03	1.00
INDLPG	0.03		0.95			0.02	1.00			0.97			0.03	1.00
INDNGL							1.00						1.00	1.00
INDCOA			1.00				1.00	0.38		0.62				1.00
INDCOK							1.00			1.00				1.00
INDCOG	0.18		0.82				1.00			1.00				1.00
INDBFG	0.06		0.91	0.01		0.02	1.00			1.00				1.00
INDOXY			1.00				1.00			1.00				1.00
INDHFO	0.18		0.82				1.00	0.25		0.74			0.01	1.00
INDOIL	0.06		0.91	0.01		0.02	1.00	0.25		0.60	0.05		0.10	1.00
INDETH							1.00						1.00	1.00
INDNAP							1.00						1.00	1.00
INDPTC							1.00						1.00	1.00
INDBIO	1.00						1.00	1.00						1.00
INDGEO	1.00						1.00	1.00						1.00
INDHET			1.00				1.00			0.55			0.45	1.00

Fuel	ISCH	ISCH	IPCH	IMCH	IECH	IFCH	IOCH	Total	ISLP	ISLP	IPLP	IMLP	IELP	IOLP	Total
INDELC			0.05	0.81	0.10		0.04	1.00			0.00	0.95	0.00	0.05	1.00
INDNGA	0.30		0.27			0.40	0.03	1.00	0.80		0.19			0.01	1.00
INDLPG						1.00		1.00	0.23		0.69			0.07	1.00
INDNGL					1.00			1.00							1.00
INDCOA	0.09		0.21			0.70		1.00	0.92		0.01			0.08	1.00
INDCOK							1.00	1.00							1.00
INDCOG			1.00					1.00	1.00						1.00
INDBFG			1.00					1.00	1.00						1.00
INDOXY			1.00					1.00	1.00						1.00
INDHFO	0.92		0.08					1.00	0.99		0.01	0.00		0.00	1.00
INDOIL	0.50		0.30	0.03		0.17		1.00	0.16		0.14			0.70	1.00
INDETH						1.00		1.00							1.00
INDNAP						1.00		1.00							1.00
INDPTC							1.00	1.00						1.00	1.00
INDBIO	1.00							1.00	1.00						1.00
INDGEO	1.00							1.00	1.00						1.00
INDHET	0.00		0.73	0.09			0.18	1.00			1.00			0.00	1.00

Fuel	ISNM	ISNM	IPNM	IMNM	IENM	IONM	Total	ISOI	ISOI	IPOI	IMOI	IEOI	IOOI	Total
INDELC			0.06	0.88	0.00	0.06	1.00			0.09	0.78	0.03	0.10	1.00
INDNGA	0.13		0.82			0.05	1.00	0.58		0.33	0.01		0.09	1.00
INDLPG	0.04		0.88			0.08	1.00	0.06		0.65	0.01		0.28	1.00
INDNGL						1.00	1.00							1.00
INDCOA			1.00				1.00	0.40		0.49			0.11	1.00
INDCOK							1.00						1.00	1.00
INDCOG			1.00				1.00	1.00						1.00
INDBFG			1.00				1.00	1.00						1.00
INDOXY			1.00				1.00	1.00						1.00
INDHFO	0.14		0.83	0.02		0.00	1.00	0.60		0.30	0.10			1.00
INDOIL	0.35		0.47	0.07		0.11	1.00	0.49		0.16	0.09		0.26	1.00
INDETH							1.00							1.00
INDNAP	0.11					0.89	1.00	0.03		0.97				1.00
INDPTC						1.00	1.00						1.00	1.00
INDBIO	1.00						1.00	1.00						1.00
INDGEO	1.00						1.00	1.00						1.00
INDHET	1.00						1.00			0.63	0.01		0.35	1.00

Table B 64. Share of industrial energy services by fuel in AUS

Fuel	ISIS	ISIS	IPIS	IMIS	IEIS	IOIS	Total	ISNF	ISNF	IPNF	IMNF	IENF	IONF	Total
INDELC			0.43	0.43	0.03	0.11	1.00				0.03	0.95	0.03	1.00
INDNGA	0.13		0.76	0.00		0.10	1.00		0.15	0.75			0.10	1.00
INDLPG			1.00				1.00			1.00				1.00
INDNGL						1.00	1.00						1.00	1.00
INDCOA			1.00				1.00			1.00				1.00
INDCOK							1.00			1.00				1.00
INDCOG			1.00				1.00						1.00	1.00
INDBFG			0.98			0.02	1.00						1.00	1.00
INDOXY			1.00				1.00						1.00	1.00
INDHFO	0.69		0.29			0.02	1.00	0.20	0.25	0.29			0.26	1.00
INDOIL	0.17		0.17			0.67	1.00	0.17		0.17			0.67	1.00
INDETH						1.00	1.00						1.00	1.00
INDNAP						1.00	1.00						1.00	1.00
INDPTC						1.00	1.00						1.00	1.00
INDBIO						1.00	1.00						1.00	1.00
INDGEO						1.00	1.00						1.00	1.00
INDHET	1.00						1.00						1.00	1.00

Fuel	ISCH	ISCH	IPCH	IMCH	IECH	IFCH	IOCH	Total	ISLP	ISLP	IPLP	IMLP	IELP	IOLP	Total
INDELC	0.02		0.04	0.65	0.13		0.16	1.00	0.02		0.03	0.80		0.15	1.00
INDNGA	0.11	0.03	0.09	0.01		0.74	0.03	1.00	0.05	0.65	0.10	0.02		0.18	1.00
INDLPG						0.96	0.04	1.00						1.00	1.00
INDNGL							1.00	1.00						1.00	1.00
INDCOA	0.30						0.70	1.00	0.50					0.50	1.00
INDCOK							1.00	1.00						1.00	1.00
INDCOG							1.00	1.00						1.00	1.00
INDBFG							1.00	1.00						1.00	1.00
INDOXY							1.00	1.00						1.00	1.00
INDHFO							1.00	1.00	0.80		0.17			0.03	1.00
INDOIL						0.60	0.40	1.00						1.00	1.00
INDETH						0.81	0.19	1.00						1.00	1.00
INDNAP							1.00	1.00						1.00	1.00
INDPTC							1.00	1.00						1.00	1.00
INDBIO							1.00	1.00	1.00						1.00
INDGEO							1.00	1.00	1.00						1.00
INDHET			1.00					1.00	1.00						1.00

Fuel	ISNM	ISNM	IPNM	IMNM	IENM	IONM	Total	ISOI	ISOI	IPOI	IMOI	IEOI	IOOI	Total
INDELC	0.01		0.24	0.59		0.17	1.00	0.01		0.10	0.50	0.04	0.35	1.00
INDNGA	0.05	0.05	0.80	0.02		0.08	1.00		0.38	0.40	0.02		0.20	1.00
INDLPG			0.50			0.50	1.00	0.15		0.50	0.05		0.30	1.00
INDNGL						1.00	1.00						1.00	1.00
INDCOA			1.00				1.00	0.75					0.25	1.00
INDCOK			1.00				1.00						1.00	1.00
INDCOG			1.00				1.00						1.00	1.00
INDBFG			1.00				1.00						1.00	1.00
INDOXY			1.00				1.00						1.00	1.00
INDHFO			1.00				1.00	0.06	0.53	0.20			0.21	1.00
INDOIL			0.90			0.10	1.00	0.28		0.20	0.12		0.40	1.00
INDETH							1.00						1.00	1.00
INDNAP							1.00						1.00	1.00
INDPTC			1.00				1.00						1.00	1.00
INDBIO	1.00						1.00	0.44	0.51				0.05	1.00
INDGEO	1.00						1.00		0.18				0.82	1.00
INDHET			1.00				1.00	1.00						1.00

Table B 65. Share of industrial energy services by fuel in CAN

Fuel	ISIS	ISIS	IPIS	IMIS	IEIS	IOIS	Total	ISNF	ISNF	IPNF	IMNF	IENF	IONF	Total
INDELC			0.43	0.43	0.03	0.11	1.00				0.03	0.95	0.03	1.00
INDNGA	0.13		0.76	0.00		0.10	1.00			0.82			0.18	1.00
INDLPG			1.00				1.00			1.00				1.00
INDNGL						1.00	1.00						1.00	1.00
INDCOA			1.00				1.00			1.00			0.01	1.00
INDCOK						0.01	1.00			1.00			0.01	1.00
INDCOG			1.00				1.00						1.00	1.00
INDBFG			1.00				1.00						1.00	1.00
INDOXY			1.00				1.00						1.00	1.00
INDHFO	0.69		0.29			0.02	1.00	0.69		0.29			0.02	1.00
INDOIL	0.17		0.17			0.67	1.00	0.17		0.17			0.67	1.00
INDETH						1.00	1.00						1.00	1.00
INDNAP						1.00	1.00						1.00	1.00
INDPTC						1.00	1.00						1.00	1.00
INDBIO						1.00	1.00						1.00	1.00
INDGEO						1.00	1.00						1.00	1.00
INDHET	1.00						1.00						1.00	1.00

Fuel	ISCH	ISCH	IPCH	IMCH	IECH	IFCH	IOCH	Total	ISLP	ISLP	IPLP	IMLP	IELP	IOLP	Total
INDELC	0.02		0.04	0.65	0.13		0.16	1.00	0.02		0.03	0.80		0.15	1.00
INDNGA	0.22		0.15	0.01		0.56	0.07	1.00	0.70		0.18	0.02		0.11	1.00
INDLPG						1.00		1.00						1.00	1.00
INDNGL							1.00	1.00						1.00	1.00
INDCOA							1.00	1.00	0.97					0.03	1.00
INDCOK							1.00	1.00						1.00	1.00
INDCOG							1.00	1.00						1.00	1.00
INDBFG							1.00	1.00						1.00	1.00
INDOXY							1.00	1.00						1.00	1.00
INDHFO							1.00	1.00	0.80		0.17			0.03	1.00
INDOIL							1.00	1.00	0.56					0.44	1.00
INDETH						1.00		1.00						1.00	1.00
INDNAP						1.00		1.00						1.00	1.00
INDPTC							1.00	1.00						1.00	1.00
INDBIO							1.00	1.00	0.90					0.10	1.00
INDGEO							1.00	1.00	1.00						1.00
INDHET			1.00					1.00	1.00						1.00

Fuel	ISNM	ISNM	IPNM	IMNM	IENM	IONM	Total	ISOI	ISOI	IPOI	IMOI	IEOI	IOOI	Total
INDELC	0.01		0.24	0.59		0.17	1.00	0.01		0.10	0.50	0.04	0.35	1.00
INDNGA	0.05		0.86	0.02		0.08	1.00	0.39		0.44	0.02		0.15	1.00
INDLPG			0.50			0.50	1.00	0.15		0.50	0.05		0.30	1.00
INDNGL						1.00	1.00						1.00	1.00
INDCOA			0.99			0.01	1.00	0.75					0.25	1.00
INDCOK			1.00				1.00						1.00	1.00
INDCOG			1.00				1.00						1.00	1.00
INDBFG			1.00				1.00						1.00	1.00
INDOXY			1.00				1.00						1.00	1.00
INDHFO			1.00				1.00	0.70		0.20			0.10	1.00
INDOIL			0.90			0.10	1.00	0.28		0.20	0.12		0.40	1.00
INDETH							1.00						1.00	1.00
INDNAP							1.00						1.00	1.00
INDPTC			1.00				1.00						1.00	1.00
INDBIO	1.00						1.00	1.00						1.00
INDGEO	1.00						1.00	1.00						1.00
INDHET			1.00				1.00	1.00						1.00

Table B 66. Share of industrial energy services by fuel in CHI

Fuel	ISIS	ISIS	IPIS	IMIS	IEIS	IOIS	Total	ISNF	ISNF	IPNF	IMNF	IENF	IONF	Total
INDELC			0.29	0.69		0.02	1.00			0.47	0.35	0.15	0.03	1.00
INDNGA	0.07		0.82			0.11	1.00	0.11		0.86			0.03	1.00
INDLPG	0.03		0.95			0.02	1.00			1.00			0.00	1.00
INDNGL							1.00						1.00	1.00
INDCOA			1.00				1.00	0.38		0.62				1.00
INDCOK							1.00			1.00				1.00
INDCOG	0.18		0.82				1.00			1.00				1.00
INDBFG	0.06		0.82				0.88			1.00				1.00
INDOXY			1.00				1.00			1.00				1.00
INDHFO	0.18		0.80				0.98	0.26		0.70	0.03		0.01	1.00
INDOIL	0.06		0.80				0.86	0.36		0.49	0.06		0.09	1.00
INDETH							1.00						1.00	1.00
INDNAP							1.00						1.00	1.00
INDPTC							1.00						1.00	1.00
INDBIO	1.00						1.00	1.00						1.00
INDGEO	1.00						1.00	1.00						1.00
INDHET			1.00				1.00			0.55			0.45	1.00

Fuel	ISCH	ISCH	IPCH	IMCH	IECH	IFCH	IOCH	Total	ISLP	ISLP	IPLP	IMLP	IELP	IOLP	Total
INDELC			0.05	0.81	0.10		0.04	1.00			0.00	0.95	0.00	0.05	1.00
INDNGA	0.12		0.33	0.02		0.51	0.02	1.00	0.80		0.19			0.01	1.00
INDLPG						1.00		1.00	0.23		0.69			0.07	1.00
INDNGL					1.00			1.00							1.00
INDCOA	0.91		0.09					1.00	0.92		0.01			0.08	1.00
INDCOK							1.00	1.00							1.00
INDCOG			1.00					1.00							
INDBFG			1.00					1.00	1.00						1.00
INDOXY			1.00					1.00	1.00						1.00
INDHFO	0.60		0.09	0.01		0.30		1.00	0.61		0.38	0.01			1.00
INDOIL	0.70		0.14	0.16				1.00	0.40		0.60				1.00
INDETH						1.00		1.00							1.00
INDNAP						1.00		1.00							1.00
INDPTC							1.00	1.00						1.00	1.00
INDBIO	1.00							1.00	1.00						1.00
INDGEO	1.00							1.00	1.00						1.00
INDHET	0.00		0.73	0.09			0.18	1.00			1.00			0.00	1.00

Fuel	ISNM	ISNM	IPNM	IMNM	IENM	IONM	Total	ISOI	ISOI	IPOI	IMOI	IEOI	IOOI	Total
INDELC			0.06	0.88	0.00	0.06	1.00			0.09	0.78	0.03	0.10	1.00
INDNGA	0.13		0.82			0.05	1.00	0.58		0.33	0.01		0.09	1.00
INDLPG	0.04		0.88			0.08	1.00	0.21		0.49	0.10		0.20	1.00
INDNGL						1.00	1.00							1.00
INDCOA			1.00				1.00	0.41		0.49			0.09	1.00
INDCOK							1.00						1.00	1.00
INDCOG			1.00				1.00							
INDBFG			1.00				1.00	1.00						1.00
INDOXY			1.00				1.00	1.00						1.00
INDHFO	0.14		0.84	0.01		0.01	1.00	0.71		0.28	0.01			1.00
INDOIL	0.30		0.44	0.06		0.20	1.00	0.48		0.13	0.07		0.32	1.00
INDETH							1.00							1.00
INDNAP	0.11					0.89	1.00							1.00
INDPTC						1.00	1.00						1.00	1.00
INDBIO	1.00						1.00	0.40		0.60				1.00
INDGEO	1.00						1.00	1.00						1.00
INDHET	1.00						1.00			0.63	0.01		0.35	1.00

Table B 67. Share of industrial energy services by fuel in CSA

Fuel	ISIS	ISIS	IPIS	IMIS	IEIS	IOIS	Total	ISNF	ISNF	IPNF	IMNF	IENF	IONF	Total
INDELC			0.29	0.69		0.02	1.00				0.03	0.95	0.03	1.00
INDNGA	0.07		0.82			0.11	1.00	0.11		0.86			0.03	1.00
INDLPG						1.00	1.00			1.00				1.00
INDNGL						1.00	1.00						1.00	1.00
INDCOA			1.00				1.00			1.00				1.00
INDCOK							1.00							1.00
INDCOG			1.00				1.00						1.00	1.00
INDBFG			1.00				1.00						1.00	1.00
INDOXY			1.00				1.00						1.00	1.00
INDHFO	0.18		0.82				1.00						1.00	1.00
INDOIL	0.06		0.90	0.01		0.03	1.00						1.00	1.00
INDETH						1.00	1.00						1.00	1.00
INDNAP						1.00	1.00						1.00	1.00
INDPTC						1.00	1.00						1.00	1.00
INDBIO						1.00	1.00						1.00	1.00
INDGEO						1.00	1.00						1.00	1.00
INDHET						1.00	1.00						1.00	1.00

Fuel	ISCH	ISCH	IPCH	IMCH	IECH	IFCH	IOCH	Total	ISLP	ISLP	IPLP	IMLP	IELP	IOLP	Total
INDELC			0.05	0.71	0.10		0.14	1.00	0.01		0.02	0.85		0.12	1.00
INDNGA	0.32		0.13	0.02		0.44	0.09	1.00	0.75		0.18			0.07	1.00
INDLPG	0.10		0.29	0.28		0.33	0.00	1.00						1.00	1.00
INDNGL							1.00	1.00						1.00	1.00
INDCOA	1.00							1.00	1.00						1.00
INDCOK	1.00							1.00							1.00
INDCOG			1.00					1.00						1.00	1.00
INDBFG			1.00					1.00						1.00	1.00
INDOXY			1.00					1.00						1.00	1.00
INDHFO	0.60		0.07	0.00			0.33	1.00	0.99		0.01	0.00		0.00	1.00
INDOIL	0.54		0.29	0.03		0.14	0.01	1.00	0.29		0.15			0.56	1.00
INDETH						1.00		1.00						1.00	1.00
INDNAP						0.96	0.04	1.00						1.00	1.00
INDPTC						1.00		1.00						1.00	1.00
INDBIO	0.22					0.78		1.00		0.74				0.26	1.00
INDGEO	1.00							1.00						1.00	1.00
INDHET	1.00							1.00						1.00	1.00

Fuel	ISNM	ISNM	IPNM	IMNM	IENM	IONM	Total	ISOI	ISOI	IPOI	IMOI	IEOI	IOOI	Total
INDELC			0.06	0.88	0.00	0.06	1.00	0.01		0.09	0.57	0.03	0.30	1.00
INDNGA	0.13		0.82			0.05	1.00	0.58		0.33	0.01		0.09	1.00
INDLPG						1.00	1.00	0.06		0.65			0.29	1.00
INDNGL						1.00	1.00			1.00				1.00
INDCOA						1.00	1.00	0.75					0.25	1.00
INDCOK			1.00				1.00			1.00				1.00
INDCOG						1.00	1.00			1.00				1.00
INDBFG						1.00	1.00						1.00	1.00
INDOXY						1.00	1.00						1.00	1.00
INDHFO	0.14		0.83	0.02		0.00	1.00	0.70		0.29	0.00		0.01	1.00
INDOIL	0.35		0.47	0.07		0.11	1.00	0.48		0.11	0.09		0.32	1.00
INDETH						1.00	1.00						1.00	1.00
INDNAP	0.11					0.89	1.00	0.03		0.97				1.00
INDPTC						1.00	1.00						1.00	1.00
INDBIO						1.00	1.00						1.00	1.00
INDGEO						1.00	1.00						1.00	1.00
INDHET						1.00	1.00						1.00	1.00

Table B 68. Share of industrial energy services by fuel in EEU

Fuel	ISIS	ISIS	IPIS	IMIS	IEIS	IOIS	Total	ISNF	ISNF	IPNF	IMNF	IENF	IONF	Total
INDELC			0.43	0.43	0.03	0.11	1.00				0.03	0.95	0.03	1.00
INDNGA	0.13	0.03	0.76	0.00		0.07	1.00			0.82			0.18	1.00
INDLPG			0.98			0.02	1.00			0.97			0.03	1.00
INDNGL						1.00	1.00						1.00	1.00
INDCOA			1.00				1.00			1.00				1.00
INDCOK						0.00	1.00			1.00			0.00	1.00
INDCOG			1.00				1.00						1.00	1.00
INDBFG		0.15	0.66			0.19	1.00						1.00	1.00
INDOXY			1.00				1.00						1.00	1.00
INDHFO	0.40	0.18	0.29			0.13	1.00	0.69		0.29			0.02	1.00
INDOIL	0.17	0.00	0.17			0.66	1.00	0.17	0.00	0.17			0.66	1.00
INDETH						1.00	1.00						1.00	1.00
INDNAP						1.00	1.00						1.00	1.00
INDPTC						1.00	1.00						1.00	1.00
INDBIO						1.00	1.00						1.00	1.00
INDGEO						1.00	1.00						1.00	1.00
INDHET	1.00						1.00						1.00	1.00

Fuel	ISCH	ISCH	IPCH	IMCH	IECH	IFCH	IOCH	Total	ISLP	ISLP	IPLP	IMLP	IELP	IOLP	Total
INDELC	0.02		0.04	0.65	0.13		0.16	1.00	0.02		0.03	0.80		0.15	1.00
INDNGA	0.18	0.03	0.12	0.01		0.64	0.03	1.00	0.10	0.48	0.18	0.02		0.23	1.00
INDLPG						0.95	0.05	1.00						1.00	1.00
INDNGL							1.00	1.00						1.00	1.00
INDCOA	0.14	0.62					0.24	1.00	0.11	0.62				0.27	1.00
INDCOK							1.00	1.00						1.00	1.00
INDCOG							1.00	1.00						1.00	1.00
INDBFG							1.00	1.00						1.00	1.00
INDOXY							1.00	1.00						1.00	1.00
INDHFO		0.35				0.00	0.65	1.00	0.30	0.34	0.17			0.19	1.00
INDOIL		0.00				0.89	0.11	1.00	0.56	0.02				0.43	1.00
INDETH						0.12	0.88	1.00						1.00	1.00
INDNAP						0.90	0.10	1.00						1.00	1.00
INDPTC							1.00	1.00						1.00	1.00
INDBIO							1.00	1.00		1.00					1.00
INDGEO							1.00	1.00						1.00	1.00
INDHET			1.00					1.00	1.00						1.00

Fuel	ISNM	ISNM	IPNM	IMNM	IENM	IONM	Total	ISOI	ISOI	IPOI	IMOI	IEOI	IOOI	Total
INDELC	0.01		0.24	0.59		0.17	1.00	0.01		0.10	0.50	0.04	0.35	1.00
INDNGA	0.05	0.02	0.86	0.02		0.06	1.00	0.29	0.13	0.44	0.02		0.12	1.00
INDLPG			0.50			0.50	1.00	0.15		0.50	0.05		0.30	1.00
INDNGL						1.00	1.00						1.00	1.00
INDCOA			1.00				1.00	0.47	0.38				0.15	1.00
INDCOK			1.00			0.00	1.00						1.00	1.00
INDCOG			1.00				1.00		0.94				0.06	1.00
INDBFG			1.00				1.00						1.00	1.00
INDOXY			1.00				1.00						1.00	1.00
INDHFO			1.00				1.00	0.40	0.22	0.20			0.18	1.00
INDOIL	0.02	0.00	0.88			0.10	1.00	0.28	0.00	0.20	0.12		0.40	1.00
INDETH							1.00		1.00					1.00
INDNAP							1.00						1.00	1.00
INDPTC			1.00				1.00						1.00	1.00
INDBIO	1.00						1.00	1.00						1.00
INDGEO			1.00				1.00	0.78					0.22	1.00
INDHET			1.00				1.00	1.00						1.00

Table B 69. Share of industrial energy services by fuel in FSU

Fuel	ISIS	ISIS	IPIS	IMIS	IEIS	IOIS	Total	ISNF	ISNF	IPNF	IMNF	IENF	IONF	Total
INDELC			0.43	0.43	0.03	0.11	1.00				0.03	0.95	0.03	1.00
INDNGA		0.05	0.69	0.00		0.25	1.00			0.82			0.18	1.00
INDLPG			1.00				1.00			1.00				1.00
INDNGL						1.00	1.00						1.00	1.00
INDCOA			1.00				1.00			1.00				1.00
INDCOK						0.00	1.00			1.00			0.01	1.00
INDCOG			1.00				1.00						1.00	1.00
INDBFG		0.16	0.62			0.22	1.00						1.00	1.00
INDOXY			1.00				1.00						1.00	1.00
INDHFO	0.01	0.42	0.29			0.29	1.00	0.02	0.46	0.28			0.24	1.00
INDOIL	0.17	0.06	0.17			0.60	1.00	0.17	0.04	0.17			0.63	1.00
INDETH						1.00	1.00						1.00	1.00
INDNAP						1.00	1.00						1.00	1.00
INDPTC						1.00	1.00						1.00	1.00
INDBIO						1.00	1.00						1.00	1.00
INDGEO						1.00	1.00						1.00	1.00
INDHET	1.00						1.00						1.00	1.00

Fuel	ISCH	ISCH	IPCH	IMCH	IECH	IFCH	IOCH	Total	ISLP	ISLP	IPLP	IMLP	IELP	IOLP	Total
INDELC	0.02		0.04	0.65	0.13		0.16	1.00	0.02		0.03	0.80		0.15	1.00
INDNGA	0.28		0.19	0.01		0.43	0.09	1.00	0.70		0.18	0.02		0.11	1.00
INDLPG						0.99	0.01	1.00		0.99				0.01	1.00
INDNGL							1.00	1.00						1.00	1.00
INDCOA	1.00							1.00	0.97					0.03	1.00
INDCOK							1.00	1.00						1.00	1.00
INDCOG							1.00	1.00						1.00	1.00
INDBFG							1.00	1.00						1.00	1.00
INDOXY							1.00	1.00						1.00	1.00
INDHFO						0.50	0.50	1.00	0.80		0.17			0.03	1.00
INDOIL		0.16					0.84	1.00	0.08	0.39				0.53	1.00
INDETH							1.00	1.00						1.00	1.00
INDNAP							1.00	1.00						1.00	1.00
INDPTC							1.00	1.00						1.00	1.00
INDBIO							1.00	1.00	1.00						1.00
INDGEO							1.00	1.00	1.00						1.00
INDHET			1.00					1.00	1.00						1.00

Fuel	ISNM	ISNM	IPNM	IMNM	IENM	IONM	Total	ISOI	ISOI	IPOI	IMOI	IEOI	IOOI	Total
INDELC	0.01		0.24	0.59		0.17	1.00	0.01		0.10	0.50	0.04	0.35	1.00
INDNGA	0.05		0.86	0.02		0.08	1.00		0.30	0.19	0.02		0.49	1.00
INDLPG			0.50			0.50	1.00		0.76	0.10	0.04		0.10	1.00
INDNGL						1.00	1.00						1.00	1.00
INDCOA			1.00				1.00	0.70	0.16				0.14	1.00
INDCOK			0.99			0.01	1.00						1.00	1.00
INDCOG			1.00				1.00		1.00					1.00
INDBFG			1.00				1.00						1.00	1.00
INDOXY			1.00				1.00						1.00	1.00
INDHFO			1.00				1.00	0.13	0.37	0.20			0.30	1.00
INDOIL			0.90			0.10	1.00	0.28	0.00	0.20	0.12		0.40	1.00
INDETH							1.00		1.00					1.00
INDNAP							1.00						1.00	1.00
INDPTC			1.00				1.00						1.00	1.00
INDBIO	1.00						1.00	0.07	0.82				0.11	1.00
INDGEO	1.00						1.00	1.00						1.00
INDHET			1.00				1.00	1.00						1.00

Table B 70. Share of industrial energy services by fuel in IND

Fuel	ISIS	ISIS	IPIS	IMIS	IEIS	IOIS	Total	ISNF	ISNF	IPNF	IMNF	IENF	IONF	Total
INDELC			0.29	0.69		0.02	1.00			0.47	0.35	0.15	0.03	1.00
INDNGA	0.07		0.82			0.11	1.00	0.11		0.86			0.03	1.00
INDLPG	0.03		0.95			0.02	1.00			1.00				1.00
INDNGL							1.00						1.00	1.00
INDCOA			1.00				1.00	0.38		0.62				1.00
INDCOK							1.00			1.00				1.00
INDCOG	0.18		0.82				1.00			1.00				1.00
INDBFG	0.06		0.91	0.01		0.02	1.00			1.00				1.00
INDOXY			1.00				1.00			1.00				1.00
INDHFO	0.18		0.82				1.00	0.25		0.74	0.01			1.00
INDOIL	0.06		0.91	0.01		0.02	1.00	0.25		0.60	0.05		0.10	1.00
INDETH							1.00						1.00	1.00
INDNAP							1.00						1.00	1.00
INDPTC							1.00						1.00	1.00
INDBIO	1.00						1.00	1.00						1.00
INDGEO	1.00						1.00	1.00						1.00
INDHET			1.00				1.00			0.55			0.45	1.00

Fuel	ISCH	ISCH	IPCH	IMCH	IECH	IFCH	IOCH	Total	ISLP	ISLP	IPLP	IMLP	IELP	IOLP	Total
INDELC			0.05	0.81	0.10		0.04	1.00			0.00	0.95	0.00	0.05	1.00
INDNGA	0.46		0.41	0.02		0.09	0.02	1.00	0.80		0.19			0.01	1.00
INDLPG						1.00		1.00	0.23		0.69			0.07	1.00
INDNGL						1.00		1.00							1.00
INDCOA	0.60		0.40					1.00	0.90		0.04			0.06	1.00
INDCOK							1.00	1.00							1.00
INDCOG			1.00					1.00	1.00						1.00
INDBFG			1.00					1.00	1.00						1.00
INDOXY			1.00					1.00	1.00						1.00
INDHFO	0.93		0.07	0.00				1.00	0.99		0.01	0.00		0.00	1.00
INDOIL	0.50		0.30	0.03		0.17		1.00	0.29		0.15			0.56	1.00
INDETH						1.00		1.00							1.00
INDNAP						1.00		1.00							1.00
INDPTC							1.00	1.00						1.00	1.00
INDBIO	1.00							1.00	1.00						1.00
INDGEO	1.00							1.00	1.00						1.00
INDHET	0.00		0.73	0.09			0.18	1.00			1.00			0.00	1.00

Fuel	ISNM	ISNM	IPNM	IMNM	IENM	IONM	Total	ISOI	ISOI	IPOI	IMOI	IEOI	IOOI	Total
INDELC			0.06	0.88	0.00	0.06	1.00			0.09	0.78	0.03	0.10	1.00
INDNGA	0.13		0.82			0.05	1.00	0.20		0.30	0.01		0.49	1.00
INDLPG	0.04		0.88			0.08	1.00	0.06		0.65	0.01		0.28	1.00
INDNGL						1.00	1.00							1.00
INDCOA	0.10		0.90				1.00	0.37		0.49			0.14	1.00
INDCOK							1.00						1.00	1.00
INDCOG			1.00				1.00	1.00						1.00
INDBFG			1.00				1.00	1.00						1.00
INDOXY			1.00				1.00	1.00						1.00
INDHFO	0.14		0.83	0.02		0.00	1.00	0.70		0.29	0.00		0.01	1.00
INDOIL	0.35		0.47	0.07		0.11	1.00	0.48		0.11	0.09		0.32	1.00
INDETH							1.00							1.00
INDNAP	0.11					0.89	1.00							1.00
INDPTC						1.00	1.00						1.00	1.00
INDBIO	1.00						1.00	1.00						1.00
INDGEO	1.00						1.00	1.00						1.00
INDHET	1.00						1.00			0.63	0.01		0.35	1.00

Table B 71. Share of industrial energy services by fuel in JPN

Fuel	ISIS	ISIS	IPIS	IMIS	IEIS	IOIS	Total	ISNF	ISNF	IPNF	IMNF	IENF	IONF	Total
INDELC			0.43	0.43	0.03	0.11	1.00				0.03	0.95	0.03	1.00
INDNGA	0.13		0.76	0.00		0.10	1.00			0.82			0.18	1.00
INDLPG			1.00				1.00			1.00				1.00
INDNGL						1.00	1.00						1.00	1.00
INDCOA			1.00				1.00			1.00				1.00
INDCOK							1.00			1.00				1.00
INDCOG			1.00				1.00						1.00	1.00
INDBFG			0.69			0.31	1.00						1.00	1.00
INDOXY			0.98			0.02	1.00						1.00	1.00
INDHFO	0.30		0.29			0.41	1.00	0.04		0.29			0.68	1.00
INDOIL	0.17		0.17			0.67	1.00	0.17		0.17			0.67	1.00
INDETH						1.00	1.00						1.00	1.00
INDNAP						1.00	1.00						1.00	1.00
INDPTC						1.00	1.00						1.00	1.00
INDBIO						1.00	1.00						1.00	1.00
INDGEO						1.00	1.00						1.00	1.00
INDHET	1.00						1.00						1.00	1.00

Fuel	ISCH	ISCH	IPCH	IMCH	IECH	IFCH	IOCH	Total	ISLP	ISLP	IPLP	IMLP	IELP	IOLP	Total
INDELC	0.02		0.04	0.65	0.13		0.16	1.00	0.02		0.03	0.80		0.15	1.00
INDNGA	0.49		0.34	0.02			0.15	1.00	0.70		0.18	0.02		0.11	1.00
INDLPG						1.00		1.00						1.00	1.00
INDNGL						1.00		1.00						1.00	1.00
INDCOA	0.24						0.76	1.00	0.34					0.66	1.00
INDCOK							1.00	1.00						1.00	1.00
INDCOG							1.00	1.00						1.00	1.00
INDBFG							1.00	1.00						1.00	1.00
INDOXY							1.00	1.00						1.00	1.00
INDHFO							1.00	1.00	0.20		0.17			0.63	1.00
INDOIL							1.00	1.00	0.56					0.44	1.00
INDETH							1.00	1.00						1.00	1.00
INDNAP						1.00		1.00						1.00	1.00
INDPTC							1.00	1.00						1.00	1.00
INDBIO							1.00	1.00	0.45					0.55	1.00
INDGEO							1.00	1.00						1.00	1.00
INDHET			1.00					1.00	1.00						1.00

Fuel	ISNM	ISNM	IPNM	IMNM	IENM	IONM	Total	ISOI	ISOI	IPOI	IMOI	IEOI	IOOI	Total
INDELC	0.01		0.24	0.59		0.17	1.00	0.01		0.10	0.50	0.04	0.35	1.00
INDNGA	0.05		0.86	0.02		0.08	1.00	0.39		0.44	0.02		0.15	1.00
INDLPG			0.50			0.50	1.00	0.15		0.50	0.05		0.30	1.00
INDNGL						1.00	1.00						1.00	1.00
INDCOA			1.00				1.00	0.20					0.80	1.00
INDCOK			1.00				1.00						1.00	1.00
INDCOG			1.00				1.00						1.00	1.00
INDBFG			1.00				1.00						1.00	1.00
INDOXY			1.00				1.00						1.00	1.00
INDHFO			1.00				1.00	0.57		0.20			0.23	1.00
INDOIL			0.87			0.13	1.00	0.28		0.20	0.12		0.40	1.00
INDETH							1.00						1.00	1.00
INDNAP							1.00						1.00	1.00
INDPTC			1.00				1.00						1.00	1.00
INDBIO	1.00						1.00	1.00						1.00
INDGEO								0.91					0.09	1.00
INDHET			1.00				1.00	1.00						1.00

Table B 72. Share of industrial energy services by fuel in MEA

Fuel	ISIS	ISIS	IPIS	IMIS	IEIS	IOIS	Total	ISNF	ISNF	IPNF	IMNF	IENF	IONF	Total
INDELC			0.43	0.43	0.03	0.11	1.00				0.03	0.95	0.03	1.00
INDNGA	0.13		0.76	0.00		0.10	1.00			0.82			0.18	1.00
INDLPG			1.00				1.00			1.00				1.00
INDNGL						1.00	1.00						1.00	1.00
INDCOA			1.00				1.00			1.00				1.00
INDCOK							1.00			1.00				1.00
INDCOG			1.00				1.00						1.00	1.00
INDBFG		0.50	0.40			0.10	1.00						1.00	1.00
INDOXY			1.00				1.00						1.00	1.00
INDHFO	0.49	0.18	0.29			0.05	1.00	0.30	0.39	0.27			0.04	1.00
INDOIL	0.17		0.17			0.67	1.00	0.15		0.14			0.71	1.00
INDETH						1.00	1.00						1.00	1.00
INDNAP						1.00	1.00						1.00	1.00
INDPTC						1.00	1.00						1.00	1.00
INDBIO						1.00	1.00						1.00	1.00
INDGEO						1.00	1.00						1.00	1.00
INDHET	1.00						1.00						1.00	1.00

Fuel	ISCH	ISCH	IPCH	IMCH	IECH	IFCH	IOCH	Total	ISLP	ISLP	IPLP	IMLP	IELP	IOLP	Total
INDELC	0.02		0.04	0.65	0.13		0.16	1.00	0.02		0.03	0.80		0.15	1.00
INDNGA	0.41	0.07	0.28	0.02		0.17	0.06	1.00	0.70		0.18	0.02		0.11	1.00
INDLPG						0.92	0.08	1.00						1.00	1.00
INDNGL						1.00		1.00						1.00	1.00
INDCOA	0.05	0.38					0.57	1.00	0.97					0.03	1.00
INDCOK							1.00	1.00						1.00	1.00
INDCOG							1.00	1.00						1.00	1.00
INDBFG							1.00	1.00						1.00	1.00
INDOXY							1.00	1.00						1.00	1.00
INDHFO		0.68					0.32	1.00	0.31	0.47	0.17			0.04	1.00
INDOIL						1.00		1.00	1.00						1.00
INDETH							1.00	1.00						1.00	1.00
INDNAP						0.51	0.49	1.00						1.00	1.00
INDPTC							1.00	1.00						1.00	1.00
INDBIO							1.00	1.00	1.00						1.00
INDGEO							1.00	1.00	1.00						1.00
INDHET			1.00					1.00	1.00						1.00

Fuel	ISNM	ISNM	IPNM	IMNM	IENM	IONM	Total	ISOI	ISOI	IPOI	IMOI	IEOI	IOOI	Total
INDELC	0.01		0.24	0.59		0.17	1.00	0.01		0.10	0.50	0.04	0.35	1.00
INDNGA	0.05		0.86	0.02		0.08	1.00	0.39	0.04	0.44	0.02		0.11	1.00
INDLPG			0.50			0.50	1.00	0.10	0.04	0.50	0.05		0.31	1.00
INDNGL						1.00	1.00						1.00	1.00
INDCOA			1.00				1.00	0.75	0.01				0.24	1.00
INDCOK			1.00				1.00						1.00	1.00
INDCOG			1.00				1.00		1.00					1.00
INDBFG			1.00				1.00						1.00	1.00
INDOXY			1.00				1.00						1.00	1.00
INDHFO		0.43	0.59				1.02	0.70	0.02	0.20			0.08	1.00
INDOIL			0.90			0.10	1.00	0.28		0.20	0.12		0.40	1.00
INDETH							1.00		0.02				0.98	1.00
INDNAP							1.00		1.00					1.00
INDPTC			1.00				1.00						1.00	1.00
INDBIO	1.00						1.00	0.47	0.52				0.01	1.00
INDGEO	1.00						1.00	1.00						1.00
INDHET			1.00				1.00	1.00						1.00

Table B 73. Share of industrial energy services by fuel in MEX

Fuel	ISIS	ISIS	IPIS	IMIS	IEIS	IOIS	Total	ISNF	ISNF	IPNF	IMNF	IENF	IONF	Total
INDELC			0.29	0.69		0.02	1.00			0.47	0.35	0.15	0.03	1.00
INDNGA	0.07		0.82			0.11	1.00	0.11		0.86			0.03	1.00
INDLPG						1.00	1.00						1.00	1.00
INDNGL						1.00	1.00						1.00	1.00
INDCOA						1.00	1.00						1.00	1.00
INDCOK							1.00						1.00	1.00
INDCOG						1.00	1.00						1.00	1.00
INDBFG						1.00	1.00						1.00	1.00
INDOXY						1.00	1.00						1.00	1.00
INDHFO	0.18		0.82				1.00						1.00	1.00
INDOIL	0.06		0.90	0.01		0.03	1.00						1.00	1.00
INDETH						1.00	1.00						1.00	1.00
INDNAP						1.00	1.00						1.00	1.00
INDPTC						1.00	1.00						1.00	1.00
INDBIO						1.00	1.00						1.00	1.00
INDGEO						1.00	1.00						1.00	1.00
INDHET						1.00	1.00						1.00	1.00

Fuel	ISCH	ISCH	IPCH	IMCH	IECH	IFCH	IOCH	Total	ISLP	ISLP	IPLP	IMLP	IELP	IOLP	Total
INDELC			0.05	0.81	0.10		0.04	1.00			0.00	0.95	0.00	0.05	1.00
INDNGA	0.50		0.24	0.02		0.19	0.05	1.00	0.80		0.19			0.01	1.00
INDLPG	0.18		0.41	0.40			0.01	1.00						1.00	1.00
INDNGL							1.00	1.00						1.00	1.00
INDCOA							1.00	1.00						1.00	1.00
INDCOK							1.00	1.00						1.00	1.00
INDCOG							1.00	1.00						1.00	1.00
INDBFG							1.00	1.00						1.00	1.00
INDOXY							1.00	1.00						1.00	1.00
INDHFO	0.93		0.07	0.00			0.00	1.00	0.99		0.01	0.00		0.00	1.00
INDOIL	0.54		0.29	0.03			0.15	1.00	0.29		0.15			0.56	1.00
INDETH						1.00		1.00						1.00	1.00
INDNAP						1.00		1.00						1.00	1.00
INDPTC							1.00	1.00						1.00	1.00
INDBIO							1.00	1.00	0.40		0.60				1.00
INDGEO							1.00	1.00						1.00	1.00
INDHET							1.00	1.00						1.00	1.00

Fuel	ISNM	ISNM	IPNM	IMNM	IENM	IONM	Total	ISOI	ISOI	IPOI	IMOI	IEOI	IOOI	Total
INDELC			0.06	0.88	0.00	0.06	1.00			0.09	0.78	0.03	0.10	1.00
INDNGA	0.25		0.70			0.05	1.00	0.58		0.33	0.01		0.09	1.00
INDLPG						1.00	1.00	0.06		0.65			0.29	1.00
INDNGL						1.00	1.00						1.00	1.00
INDCOA						1.00	1.00						1.00	1.00
INDCOK			1.00				1.00			1.00				1.00
INDCOG						1.00	1.00						1.00	1.00
INDBFG						1.00	1.00						1.00	1.00
INDOXY						1.00	1.00						1.00	1.00
INDHFO	0.14		0.83	0.02		0.00	1.00	0.70		0.29	0.00		0.01	1.00
INDOIL	0.35		0.47	0.07		0.11	1.00	0.48		0.11	0.09		0.32	1.00
INDETH						1.00	1.00						1.00	1.00
INDNAP	0.11					0.89	1.00	0.03		0.97				1.00
INDPTC						1.00	1.00						1.00	1.00
INDBIO						1.00	1.00						1.00	1.00
INDGEO						1.00	1.00						1.00	1.00
INDHET						1.00	1.00						1.00	1.00

Table B 74. Share of industrial energy services by fuel in ODA

Fuel	ISIS	ISIS	IPIS	IMIS	IEIS	IOIS	Total	ISNF	ISNF	IPNF	IMNF	IENF	IONF	Total
INDELC			0.29	0.69		0.02	1.00			0.47	0.35	0.15	0.03	1.00
INDNGA	0.07		0.82			0.11	1.00	0.11		0.86			0.03	1.00
INDLPG	0.03		0.95			0.02	1.00			1.00			0.00	1.00
INDNGL							1.00						1.00	1.00
INDCOA			1.00				1.00	0.38		0.62				1.00
INDCOK							1.00			1.00				1.00
INDCOG	0.18		0.82				1.00			1.00				1.00
INDBFG	0.06		0.92			0.02	1.00			1.00				1.00
INDOXY			1.00				1.00			1.00				1.00
INDHFO	0.18		0.82				1.00	0.25		0.74	0.01			1.00
INDOIL	0.06		0.84	0.08		0.02	1.00	0.25		0.59	0.05		0.11	1.00
INDETH							1.00							1.00
INDNAP							1.00							1.00
INDPTC							1.00						1.00	1.00
INDBIO	1.00						1.00	1.00						1.00
INDGEO	1.00						1.00	1.00						1.00
INDHET			1.00				1.00			0.55			0.45	1.00

Fuel	ISCH	ISCH	IPCH	IMCH	IECH	IFCH	IOCH	Total	ISLP	ISLP	IPLP	IMLP	IELP	IOLP	Total
INDELC			0.05	0.81	0.10		0.04	1.00			0.00	0.95	0.00	0.05	1.00
INDNGA	0.08		0.13	0.00		0.78	0.00	1.00	0.80		0.19			0.01	1.00
INDLPG						1.00		1.00	0.23		0.69			0.07	1.00
INDNGL						1.00		1.00							1.00
INDCOA	1.00							1.00	0.89		0.01			0.10	1.00
INDCOK							1.00	1.00							1.00
INDCOG			1.00					1.00							
INDBFG			1.00					1.00	1.00						1.00
INDOXY			1.00					1.00	1.00						1.00
INDHFO	0.69		0.05	0.00		0.26		1.00	0.90		0.10	0.00		0.00	1.00
INDOIL	0.50		0.30	0.03		0.17		1.00	0.29		0.15			0.56	1.00
INDETH						1.00		1.00							1.00
INDNAP						1.00		1.00							1.00
INDPTC							1.00	1.00						1.00	1.00
INDBIO	1.00							1.00	0.40		0.60				1.00
INDGEO	1.00							1.00	1.00						1.00
INDHET	0.00		0.73	0.09			0.18	1.00			1.00			0.00	1.00

Fuel	ISNM	ISNM	IPNM	IMNM	IENM	IONM	Total	ISOI	ISOI	IPOI	IMOI	IEOI	IOOI	Total
INDELC			0.06	0.88	0.00	0.06	1.00			0.09	0.78	0.03	0.10	1.00
INDNGA	0.13		0.82			0.05	1.00	0.49		0.38	0.01		0.12	1.00
INDLPG	0.04		0.88			0.08	1.00	0.06		0.65	0.01		0.28	1.00
INDNGL						1.00	1.00							1.00
INDCOA			1.00				1.00	0.41		0.49			0.10	1.00
INDCOK							1.00						1.00	1.00
INDCOG			1.00				1.00							
INDBFG			1.00				1.00	1.00						1.00
INDOXY			1.00				1.00	1.00						1.00
INDHFO	0.13		0.84	0.02		0.00	1.00	0.70		0.29	0.00		0.01	1.00
INDOIL	0.35		0.47	0.07		0.11	1.00	0.47		0.13	0.08		0.32	1.00
INDETH							1.00							1.00
INDNAP							1.00							1.00
INDPTC						1.00	1.00	1.00						1.00
INDBIO	1.00						1.00	1.00						1.00
INDGEO	1.00						1.00	1.00						1.00
INDHET	1.00						1.00			0.63	0.01		0.35	1.00

Table B 75. Share of industrial energy services by fuel in SKO

Fuel	ISIS	ISIS	IPIS	IMIS	IEIS	IOIS	Total	ISNF	ISNF	IPNF	IMNF	IENF	IONF	Total
INDELC			0.29	0.69		0.02	1.00			0.47	0.35	0.15	0.03	1.00
INDNGA	0.07		0.82			0.11	1.00	0.11		0.86			0.03	1.00
INDLPG	0.03		0.95			0.02	1.00			1.00			0.00	1.00
INDNGL							1.00						1.00	1.00
INDCOA			1.00				1.00	0.38		0.62				1.00
INDCOK							1.00							1.00
INDCOG	0.18		0.82				1.00			1.00				1.00
INDBFG		1.00					1.00			1.00				1.00
INDOXY			1.00				1.00			1.00				1.00
INDHFO	0.18		0.82				1.00	0.25		0.74	0.01		0.00	1.00
INDOIL	0.06		0.91	0.01		0.02	1.00	0.25		0.59	0.05		0.11	1.00
INDETH							1.00							1.00
INDNAP							1.00							1.00
INDPTC							1.00						1.00	1.00
INDBIO	1.00						1.00	1.00						1.00
INDGEO	1.00						1.00	1.00						1.00
INDHET			1.00				1.00			0.55			0.45	1.00

Fuel	ISCH	ISCH	IPCH	IMCH	IECH	IFCH	IOCH	Total	ISLP	ISLP	IPLP	IMLP	IELP	IOLP	Total
INDELC			0.05	0.81	0.10		0.04	1.00			0.00	0.95	0.00	0.05	1.00
INDNGA	0.63		0.33	0.02			0.02	1.00	0.80		0.19			0.01	1.00
INDLPG						1.00		1.00	0.23		0.69			0.07	1.00
INDNGL						1.00		1.00							1.00
INDCOA	0.91		0.09					1.00	0.92		0.01			0.08	1.00
INDCOK						1.00		1.00							1.00
INDCOG			1.00					1.00		1.00					1.00
INDBFG			1.00					1.00							1.00
INDOXY			1.00					1.00	1.00						1.00
INDHFO	0.93		0.07	0.00				1.00	0.99		0.01	0.00		0.00	1.00
INDOIL	0.50		0.30	0.03		0.17		1.00	0.29		0.15			0.56	1.00
INDETH						1.00		1.00							1.00
INDNAP						1.00		1.00							1.00
INDPTC							1.00	1.00						1.00	1.00
INDBIO	1.00							1.00							1.00
INDGEO	1.00							1.00	1.00						1.00
INDHET	0.00		0.73	0.09			0.18	1.00			1.00			0.00	1.00

Fuel	ISNM	ISNM	IPNM	IMNM	IENM	IONM	Total	ISOI	ISOI	IPOI	IMOI	IEOI	IOOI	Total
INDELC			0.06	0.88	0.00	0.06	1.00			0.09	0.78	0.03	0.10	1.00
INDNGA	0.13		0.82			0.05	1.00	0.58		0.33	0.01		0.09	1.00
INDLPG	0.04		0.88			0.08	1.00	0.06		0.65	0.01		0.28	1.00
INDNGL						1.00	1.00							1.00
INDCOA			1.00				1.00	0.41		0.49			0.09	1.00
INDCOK							1.00						1.00	1.00
INDCOG			1.00				1.00		1.00					1.00
INDBFG			1.00				1.00							
INDOXY			1.00				1.00	1.00						1.00
INDHFO	0.14		0.83	0.02		0.00	1.00	0.70		0.29	0.00		0.01	1.00
INDOIL	0.35		0.47	0.07		0.11	1.00	0.48		0.11	0.09		0.32	1.00
INDETH							1.00							1.00
INDNAP							1.00							1.00
INDPTC						1.00	1.00						1.00	1.00
INDBIO	1.00						1.00	1.00						1.00
INDGEO	1.00						1.00	1.00						1.00
INDHET	1.00						1.00			0.63	0.01		0.35	1.00

Table B 76. Share of industrial energy services by fuel in USA

Fuel	ISIS	ISIS	IPIS	IMIS	IEIS	IOIS	Total	ISNF	ISNF	IPNF	IMNF	IENF	IONF	Total
INDELC			0.43	0.43	0.03	0.11	1.00				0.03	0.95	0.03	1.00
INDNGA	0.13		0.76	0.00		0.10	1.00	0.10		0.85			0.05	1.00
INDLPG			1.00				1.00			1.00				1.00
INDNGL						1.00	1.00						1.00	1.00
INDCOA	0.05		0.95				1.00	0.05		0.95				1.00
INDCOK							1.00							1.00
INDCOG		1.00					1.00						1.00	1.00
INDBFG		0.38	0.60			0.02	1.00						1.00	1.00
INDOXY			1.00				1.00						1.00	1.00
INDHFO	0.04	0.79	0.15			0.02	1.00	0.69		0.29			0.02	1.00
INDOIL	0.17	0.54	0.17			0.12	1.00	0.17		0.17			0.67	1.00
INDETH						1.00	1.00						1.00	1.00
INDNAP						1.00	1.00						1.00	1.00
INDPTC						1.00	1.00						1.00	1.00
INDBIO						1.00	1.00						1.00	1.00
INDGEO						1.00	1.00						1.00	1.00
INDHET	1.00						1.00						1.00	1.00

Fuel	ISCH	ISCH	IPCH	IMCH	IECH	IFCH	IOCH	Total	ISLP	ISLP	IPLP	IMLP	IELP	IOLP	Total
INDELC	0.02		0.04	0.65	0.13		0.16	1.00			0.05	0.85		0.10	1.00
INDNGA	0.49	0.13	0.34	0.02			0.02	1.00	0.10	0.70	0.18	0.02		0.01	1.00
INDLPG						1.00		1.00						1.00	1.00
INDNGL							1.00	1.00						1.00	1.00
INDCOA	1.00							1.00	0.10	0.89				0.01	1.00
INDCOK							1.00	1.00						1.00	1.00
INDCOG							1.00	1.00						1.00	1.00
INDBFG							1.00	1.00						1.00	1.00
INDOXY							1.00	1.00						1.00	1.00
INDHFO		1.00					0.00	1.00		0.84	0.13			0.03	1.00
INDOIL		0.23					0.77	1.00	0.24	0.31				0.45	1.00
INDETH						1.00		1.00						1.00	1.00
INDNAP						1.00		1.00						1.00	1.00
INDPTC							1.00	1.00						1.00	1.00
INDBIO							1.00	1.00	0.22	0.73				0.05	1.00
INDGEO							1.00	1.00	1.00						1.00
INDHET			1.00					1.00	1.00						1.00

Fuel	ISNM	ISNM	IPNM	IMNM	IENM	IONM	Total	ISOI	ISOI	IPOI	IMOI	IEOI	IOOI	Total
INDELC	0.01		0.15	0.75		0.09	1.00	0.01		0.10	0.70	0.04	0.15	1.00
INDNGA	0.05		0.86	0.02		0.08	1.00		0.75	0.20	0.02		0.03	1.00
INDLPG			0.50			0.50	1.00	0.15		0.50	0.05		0.30	1.00
INDNGL						1.00	1.00						1.00	1.00
INDCOA		0.23	0.77			0.00	1.00	0.11	0.89				0.00	1.00
INDCOK			1.00				1.00						1.00	1.00
INDCOG			1.00				1.00						1.00	1.00
INDBFG			1.00				1.00						1.00	1.00
INDOXY			1.00				1.00						1.00	1.00
INDHFO			1.00				1.00		0.99				0.01	1.00
INDOIL	0.10		0.80			0.10	1.00	0.28	0.02	0.20	0.12		0.38	1.00
INDETH							1.00						1.00	1.00
INDNAP							1.00						1.00	1.00
INDPTC			1.00				1.00		1.00					1.00
INDBIO	1.00						1.00	1.00						1.00
INDGEO	1.00						1.00						1.00	1.00
INDHET			1.00				1.00	1.00						1.00

Table B 77. Share of industrial energy services by fuel in WEU

Fuel	ISIS	ISIS	IPIS	IMIS	IEIS	IOIS	Total	ISNF	ISNF	IPNF	IMNF	IENF	IONF	Total
INDELC			0.43	0.43	0.03	0.11	1.00				0.03	0.95	0.03	1.00
INDNGA	0.13	0.29	0.36	0.00		0.21	1.00			0.82			0.18	1.00
INDLPG			1.00				1.00			1.00				1.00
INDNGL						1.00	1.00						1.00	1.00
INDCOA		0.07	0.20			0.73	1.00			1.00				1.00
INDCOK							1.00			1.00				1.00
INDCOG			1.00				1.00						1.00	1.00
INDBFG		0.49	0.40			0.11	1.00						1.00	1.00
INDOXY		0.50	0.50				1.00						1.00	1.00
INDHFO	0.69		0.29			0.02	1.00	0.69		0.29			0.02	1.00
INDOIL	0.17		0.17			0.67	1.00	0.17		0.17			0.67	1.00
INDETH						1.00	1.00						1.00	1.00
INDNAP						1.00	1.00						1.00	1.00
INDPTC						1.00	1.00						1.00	1.00
INDBIO						1.00	1.00						1.00	1.00
INDGEO						1.00	1.00						1.00	1.00
INDHET	1.00						1.00						1.00	1.00

Fuel	ISCH	ISCH	IPCH	IMCH	IECH	IFCH	IOCH	Total	ISLP	ISLP	IPLP	IMLP	IELP	IOLP	Total
INDELC	0.02		0.04	0.65	0.13		0.16	1.00	0.02		0.03	0.80		0.15	1.00
INDNGA	0.06	0.21	0.02			0.36	0.34	1.00	0.06	0.41				0.53	1.00
INDLPG		0.00				0.93	0.07	1.00		0.00				1.00	1.00
INDNGL							1.00	1.00						1.00	1.00
INDCOA	0.05	0.06					0.89	1.00	0.05	0.05				0.90	1.00
INDCOK							1.00	1.00						1.00	1.00
INDCOG		0.62					0.38	1.00		0.97				0.03	1.00
INDBFG							1.00	1.00						1.00	1.00
INDOXY							1.00	1.00						1.00	1.00
INDHFO		0.14				0.08	0.78	1.00	0.03	-0.05	0.01			1.01	1.00
INDOIL		0.04				0.88	0.09	1.00	0.50	0.36				0.14	1.00
INDETH		0.02				0.77	0.21	1.00		1.00					1.00
INDNAP						0.99	0.01	1.00						1.00	1.00
INDPTC		0.29					0.71	1.00		1.00					1.00
INDBIO		0.61					0.39	1.00	0.04	0.61				0.35	1.00
INDGEO							1.00	1.00	1.00						1.00
INDHET			1.00					1.00	1.00						1.00

Fuel	ISNM	ISNM	IPNM	IMNM	IENM	IONM	Total	ISOI	ISOI	IPOI	IMOI	IEOI	IOOI	Total
INDELC	0.01		0.24	0.59		0.17	1.00	0.01		0.10	0.50	0.04	0.35	1.00
INDNGA	0.02	0.43	0.10			0.45	1.00	0.19	0.22	0.22	0.02		0.35	1.00
INDLPG			0.50			0.50	1.00	0.15	0.00	0.50	0.05		0.30	1.00
INDNGL						1.00	1.00						1.00	1.00
INDCOA		0.05	0.15			0.80	1.00	0.05	0.06				0.89	1.00
INDCOK			1.00				1.00						1.00	1.00
INDCOG			1.00				1.00		0.28				0.72	1.00
INDBFG			1.00				1.00						1.00	1.00
INDOXY			1.00				1.00						1.00	1.00
INDHFO		0.33	0.10			0.57	1.00	0.32	0.11	0.07			0.50	1.00
INDOIL			0.90			0.10	1.00	0.28	0.00	0.20	0.12		0.40	1.00
INDETH							1.00		0.09				0.91	1.00
INDNAP							1.00						1.00	1.00
INDPTC			1.00				1.00		0.02				0.98	1.00
INDBIO	0.17	0.42				0.41	1.00	0.09	0.54				0.37	1.00
INDGEO	1.00						1.00	1.00						1.00
INDHET			1.00				1.00	1.00						1.00