

## SESAM Documentation Files

There are four types of documentation files:

- 1) Standard scenario documentation files
- 2) Ad hoc scenario documentation files
- 3) Economic costs documentation files
- 4) Comparative scenario analysis documentation files

Each file of type 1) - 3) pertains to one particular scenario. Type 4) files contain results for several scenarios.

For each scenario, the **standard** scenario documentation files contain documentation of results for the energy system as a whole. All these files have a filename extension identical to the scenario's two-letter scenario identifier. They are produced by the main program modules SESAM10, SESAM60, and SESAM80 (when a complete scenario run is started up by the SESAM command, standard documentation files are produced automatically by the SESAM51 program also).

**Ad hoc** scenario documentation files contain results pertaining to particular subsystems or other entities for which the user wishes to inspect the results. They are generated by the print-out programs shown in the MENU. Each of these programs display a menu from which the user is requested to select the subsystems or entities to be documented.

For each scenario, **economic cost** documentation files can be produced by the COSTS (SESAM100) program. When the program starts, the user is requested to select the hardware and fuel price scenarios as well as the discount rate to be used in the computations.

The **comparative** scenario analysis files are produced by the programs COMPARE (SESAM90), MAINTABS (SESAM91), and ANALYSIS (SESAM92). These programs produce tables in which results from a number of different scenarios are presented in parallel columns or lines for comparison. The ANALYSIS program also prints out the results of partial differential analyses with respect to changes in the macro-variables. When a program is started, the user is requested to select the scenarios to be compared.

## Standard Scenario Documentation Files. Summary of Contents

The **names** of the standard scenario documentation files are given in **section 12 of the SESSETUP document**. The names of other documentation files are chosen by the user when the documentation programs are started up.

The filenames used below are the standard names. The user may choose other filenames by changing the names given in section 12 of the SESSETUP document. More detailed descriptions of the file contents are given in the section "Documentation File Contents" below.

If the model comprises several countries or regions, some result files are produced for each of the countries/regions. In these cases the filenames for a particular country or region are construed by the replacing of the last letters of the standard file name by the 3-letter country/region identifier. For example, in a model comprising the four Nordic countries with the identifiers NOR, SWE, FIN, and DEN, the SUMMARY for particular scenario contains results for all the four countries in total, while SUMMANOR contains results for Norway.

Files produced by the **SESAM10** program module:

FLOORAREAs	The development in <b>floor areas</b> by consumer categories and building categories.
HEATBALance	Detailed annual and monthly <b>heat balance accounts</b> for each building category.
HEATSUMMary	Annual summary accounts of <b>heat consumption</b> for room heating and hot water, by building category. Total account for the system as a whole at the bottom of the file. These files are produced for one-country/region models only.

Files produced by the **SESAM51** print-out programme:

SUMMARY	A <b>total energy consumption and production</b> account. Annual production results for the different energy conversion stations, grouped as specified in the CSGROUPS file (Conversion Station groups). <b>Electric power generation</b> in the different type of power and cogeneration stations found at the bottom of the file.
EMISSIONs	<b>Fuel consumption and emission</b> results for the system as a whole and for each of the conversion station groups specified in the CSGROUPS file.
MARGINAL	Marginal changes in fuel consumption and emissions as a result of marginal changes in heat consumption, electricity consumption, wind power generation, and heat production from solar collectors.

Files produced by the **SESAM60** program module:

CAPSPECification	Capacity specifications. Detailed year by year accounts of the computed energy <b>conversion unit capacities</b> in all power generating conversion stations.
ELBALANCe	Annual and monthly <b>electricity balance</b> accounts for the system as a whole.
POWERRATe	<b>Power rate balances</b> for the system as a whole at 30 minutes intervals (for the months February and July only).

Files produced by the **SESAM80** program:

ALLDOMAINs	<p>A large document containing main result for the system as a whole (All Domains):</p> <ul style="list-style-type: none"><li>- <b>heat consumption</b> accounts and specific heat consumption data;</li><li>- <b>electricity consumption</b> accounts;</li><li>- summaries of the stock development and the efficiency factor development for <b>electrical appliances</b>;</li><li>- changes in the <b>heat supply</b> structure;</li><li>- production and consumption data for specific <b>industrial processes</b>;</li><li>- production accounts, technical parameters, and fuel consumption for the different categories of <b>stationary conversion stations</b>: cogeneration stations, district heating stations, individual boilers, etc.;</li><li>- <b>biogas</b> production specifications;</li><li>- total <b>fuel consumption and emission</b> accounts;</li><li>- power generation accounts for <b>geophysical energy sources</b>.</li></ul> <p>At the bottom of this file a <b>total energy balance account</b> for the system as a whole is shown.</p>
EFFICIENcy	<p>Summary of production data for <b>cogeneration stations</b>. An account of the <b>thermodynamic efficiency</b> of the energy conversion and transmission system as a whole, in terms of exergy.</p>
HEATSUPPLY	<p><b>Heat supply survey</b>: Number of buildings, domain by domain, heated by different types of individual heating installations or district heating. Total heat supply survey for the system as a whole. For multi-country/region models result tables for each country/region are displayed. Totals for each country/region at the bottom of the file.</p>

## Documentation File Contents

Most of the bigger documentation files are divided into text sections. The first characters in each section are **\$:**, followed by a section number or a text heading. Thus, using a text editor it is easy to scan the document, jumping from one section to the next by searching for the next \$ character.

In the following the contents of the documentation files produced by the different programs are described. For the EL1 and EL2 print-out programs, the names of the documentation files here chosen are **SESAMEL1.txt** and **SESAMEL2.txt**. For the other ad hoc documentation files, the names **SESAMdd.txt**, where dd is the MENU print-out program no., are chosen.

### Results from the EL program:

**SESAMEL1.txt:** Development in **number of appliances, quality-mix and electricity consumption** for:

- one of the stock development scenarios: H, M, or L, specified in the ELDATA file
- one of the consumer groups
- one of the quality-mix and behavioral development scenarios: 1, 2, or 3, specified in the ELDATA file
- one or more of the appliances used by the chosen consumer category

The selection is made from the menus displayed by the EL1 program.

**SESAMEL2.txt** Development in **electricity consumption** by consumer category.

### Results from the SESAM10 program module:

**SESAM11.txt** **Number of buildings registered** in the building register within a domain, an EUS district, or the region as a whole, by type of heat supply.

**SESAM12.txt** **Heat and electricity consumption by consumer category** for a domain, the buildings connected to particular heat supply installations, or the region as a whole.

**FLOORAREAs** The development in **floor areas** by consumer category and building category.

**HEATBALAncE** Section 1: Average monthly **outdoor temperatures**.

Following sections:

One section for each building group, containing annual and monthly **heat balance data for each building category** belonging to the group.

**HEATSUMMary** **Floor areas** and annual **heat consumption** data - electric and thermal - for each building category, one section for each building group.

The last section contains an annual heat consumption account for the system as a whole.

Results from the SESAM50 program module:

SUMMARY	<p>Standard scenario documentation file, produced by the SESAM51 program.</p> <p><u>Section 1:</u> Summary of annual <b>heat and power consumption and production</b>. Total <b>seasonal heat storage</b> capacity. <b>Fuel</b> consumption in stationary plants and vehicles. <b>El-export</b> month by month. <b>Heat surplus from motors</b>.</p> <p><u>Section 2:</u> <b>Heat production</b> (incl. heat from heat pumps) in the different types of conversion stations, grouped as specified in the CSGROUPS file.</p> <p><u>Section 3:</u> <b>Heat production in heat pumps</b> in the different types of conversion stations, grouped as specified in the CSGROUPS file.</p> <p><u>Section 4:</u> <b>Electricity production</b> in the different types of conversion stations, grouped as specified in the CSGROUPS file.</p>
EMISSIONs	<p><b>Fuel consumption and emissions.</b> Standard documentation file produced by the SESAM51 program.</p> <p>Results for</p> <ul style="list-style-type: none"><li>- each stationary station or</li><li>- each group of stationary stations (groups specified in the CSGROUPS document)</li></ul> <p>and for</p> <ul style="list-style-type: none"><li>- transportation and</li><li>- the system as a whole.</li></ul> <p>The degree of detail to be chosen from the menu displayed when starting up the SESAM51 program.</p> <p>Emission <b>reductions in flue gas purification plants</b> shown in the last section of the file.</p>
MARGINAL	<p>Standard documentation file produced by the SESAM51 program.</p> <p>Relative <b>marginal changes</b> in</p> <ol style="list-style-type: none"><li>a) total annual fuel consumption (PJ)</li><li>b) SO<sub>2</sub> emission</li><li>c) NO<sub>x</sub> emission</li><li>d) CO<sub>2</sub> emission</li><li>e) Electricity export</li></ol> <p>as a result of</p> <ol style="list-style-type: none"><li>1) an increase in heat consumption of 1 PJ</li><li>2) an increase in electricity consumption of 1 PJ</li><li>3) an increase in electricity production in windmills of 1 PJ</li><li>4) an increase in district heat production in solar panels of 1 PJ</li><li>5) an increase in heat production in individual solar panels of 1 PJ.</li></ol>

The marginal changes are computed year by year. For each year the results are obtained by increasing in succession the monthly values of one the parameters 1) - 5) by 5 percent. The marginal changes take place in the energy flow computations in the SESAM50 program module only. Therefore, they indicate only the sensitivity of the system to marginal changes which are not taken into account in the distribution of heat and power production taking place in the previous program modules SESAM10 - SESAM40. The comparative scenario analysis program SESAM92 perform sensitivity analyses in which all the effects upon the system as a whole of changes in the macro-variables defined in section 6.5 are taken into account.

Results produced by the SESAM52 - SESAM56 documentation programs:

- SESAM52.txt    Annual and **monthly**
- **heat** consumption and heat production data
  - **electricity** consumption and electricity production data
- for
- the regional system as a whole, or
  - one or more domains, or
  - one or more conversion stations and the connected buildings within one or more domains
- One section for each year.  
For each system or subsystem chosen, heat consumption equals heat production month by month. For the regional system as a whole, electricity consumption (including export out of the region) equals electricity production.
- SESAM53.txt    Fuel consumption in conversion stations partly or fully fired with **biomass fuels** and **combustible waste**.  
Total consumption of biomass fuels and combustible waste.
- SESAM54.txt    **Technical parameters**, compiled from the CONVSTAT and the CONVUNIT documents:
- power and heat rates for motors
  - thermal efficiencies for boilers
  - electricity consumption in boilers, district heating networks, collective solar absorption plants (relative to heat production)
  - heat losses in district heating networks, relative to production.
  - losses in electric grids
  - district heating temperatures
  - heat pump reservoir temperatures
  - boilers share of heat production (specified in CONVSTAT)
- and computed values:
- heat pump inlet and outlet temperatures
  - heat pump efficiency factor (ratio of heat output to power input)

- boilers share of heat production (realized).
- SESAM55.txt Heat surplus from motors, i.e. heat from cooling circuits and stacks at a temperature sufficiently high for district heating/central heating which is not utilized for heating.
- SESAM56.txt Electricity consumption, total heat production, total district heat production, heat surplus from motors.  
For one or more domains, one or more conversion stations, or for the regional system as a whole.

Results from the SESAM60 program module:

- CAPSPECification **Capacities and utilization** of
- energy conversion units (motors, heat pumps, boilers)
  - heat storage tanks (not seasonal)
  - flue gas purification plants (SO<sub>2</sub> and NO<sub>x</sub>).
- One section for each year, containing one record for each conversion station.
- POWERRATE Diurnal **power rate** (MW) balance for the energy system as a whole **for every 30 minutes**. Specified by
- electricity consumption
  - power consumption in heat pumps
  - power consumption in electrolytic converters
  - electricity import/export
  - power generation in windmills
  - power generation in photovoltaic panels
  - power generation in fuel based conversion stations with fixed diurnal production rates
  - power from hydropower stations
  - power from fuel based conversion stations with variable diurnal production rates.
- For each scenario year, results are presented for one day representative of **February** and one day representative of **July** in three cases:
- 1) **mean** wind and sun
  - 2) **weak** wind and sun
  - 3) **strong** wind and sun;
- as defined in the SESSETUP document, section 1.  
The results are presented in tables and graphs.
- ELBALANCE Section 1:
- **max. electricity consumption rate** (MW) and
  - electricity **generation capacities** (MW)
- Following sections (one section for each scenario year):
- average monthly electricity production and consumption rates (MW)
  - max. and min. electricity import and export rate (MW)
- as computed in the three cases:
- 1) **mean** wind and sun
  - 2) **weak** wind and sun
  - 3) **strong** wind and sun
- as defined in the SESSETUP document, section 1.

Results from the SESAM70 program module:

- SESAM71.txt    **Result transferred to the economic costs computation**  
programs SESAM92 and SESAM100:
- increases in numbers or capacities of hardware items, to which economic costs are to be assigned.
  - reductions in heat transmission losses from buildings, to which costs of thermal insulation are to be assigned.
  - stock increases of new, more efficient electrical appliances to which additional purchasing costs are to be assigned.
  - annual fuel consumption quantities to which fuel costs are to be assigned.
- The results to be displayed are chosen from menus displayed when the SESAM71 program is started up.

Results from the SESAM80 documentation program module:

- ALLDOMAIn    Main results for the energy system as a whole (All domains):
- Section 1: Heat consumption
- Section 1.1:
- net heat consumption
  - hot water consumption
  - secondary district heating pipe losses.
- Section 1.2 - 1.3: Data compiled from the SHBALANCE document:
- Section 1.2: Specific heat transmission loss data (GJ per 100 sq.metres) by building category
- Section 1.3: Number of sq.metres per person by building category
- Section 1.4: Hot water consumption litres per day per person by consumer category
- Section 2: Electricity consumption
- Section 2.1: Electricity consumption:
- for electrical appliances, lighting, hot water, etc. by consumer category.
  - for industrial processes
  - for electric room heating
  - in energy conversion stations and district heating networks (pumps, etc.).
- and
- losses in electric grids
- Section 2.2: Electrical appliances. Changes in consumption due to
- 1) stock development and
  - 2) development in appliance efficiencies
- Section 3: Specific major consumers (industries and other, specified in the SPECPROC document):
- process heat consumption
  - process electricity consumption
  - district heat production
  - electricity production
  - district heat consumption



- Section 4: **Heat supply installations:**  
Number of buildings supplied from district heating networks, natural gas networks, and different types of individual heat supply installations (as specified in the SESSETUP document, section 10).
- Section 5: Geophysical power sources: **Windmills, photovoltaic panels, hydropower:**  
- annual production  
- installed capacities (max. production rates, MW, for windmills and photovoltaic panels)  
- max. transmission rates for power from hydropower stations.
- Section 6: Aggregated **production data**, average values of **technical parameters**, and **fuel consumption** for:  
- cogeneration plants  
- districts heating plants  
- individual heat supply installations (boilers, small cogeneration units)  
- industrial cogeneration plants
- Section 7: **Biogas plants:** Gas production; biomass consumption; heat and power consumption.
- Section 8: **Fuel consumption:**  
Section 8.1: Total consumption of fossil and local fuels, including consumption in external power stations.  
Section 8.2: For each type of fuel:  
Consumption distributed on types of conversion units.
- Section 9: **Emissions:** CO<sub>2</sub>, SO<sub>2</sub>, NO<sub>x</sub>, and particles.
- Section 10: Heat and electricity **balance accounts for the system as a whole.**

EFFICIENCY Total **production data** (motors, heat pumps, boilers) for  
- central power- and cogeneration plants  
- decentral power- and cogeneration plants.  
(Central power- and cogeneration plants named in the SESSETUP document, section 2).  
- **thermodynamic efficiency** of the system as a whole (in terms of exergy).

HEATSUPPLY **Heat supply survey:**  
One section for each domain containing:  
- number of buildings supplied with **district heating**  
- number of buildings supplied with **natural gas**  
- numbers of buildings heated by different types of **individual heating** installations.  
One section containing the total numbers for the system as a whole (all domains).  
One summary section containing:  
- heat consumption covered by  
- districts heating

- different types of fuels burned in individual heating installations
- electric heating
- individual solar absorbers
- distribution of heat consumption on domains.

In addition to the standard documentation files, a number of ad hoc documentation files can be selected from the menu displayed by the SESAM80 program:

DOMAIN	Contains the same sections as the ALLDOMAIns file but for one domain only. (Menu 2)
LOCALSYS	Contains the same sections - except sections 5 and 10 - as the ALLDOMAIns file but for one or more local systems only. Section 6 is disaggregated: production values, technical parameters, and fuel consumption is shown for each conversion station. (Menu 4)
LOCDETAILS	<b>Detailed account</b> of heat consumption, fuel consumption, and emissions for one or more <b>local systems</b> . (Menu 8)
CONVSTAT	Production data and technical parameters for conversion stations. (Menu 3)
POWERGEN	<p><b>Power and cogeneration stations:</b> (Menu 7)</p> <p><u>Section 1:</u> For each local system:</p> <ul style="list-style-type: none"> <li>- utilized capacities of <b>motors</b> (MW power) and <b>heat pumps</b> (MW thermal)</li> <li>- <b>utilization</b> of motor capacities (hours/year)</li> </ul> <p><u>Section 2:</u></p> <ul style="list-style-type: none"> <li>- utilized power generation capacities in <b>decentral</b> and <b>central</b> power and cogeneration stations (central stations named in the SESSETUP document, section 2)</li> <li>- utilized power generation capacities in <b>industrial</b> cogeneration plants</li> <li>- total power generation account: <ul style="list-style-type: none"> <li>- <b>decentral</b> power and cogeneration stations</li> <li>- <b>central</b> power and cogeneration stations</li> <li>- <b>windpower</b></li> <li>- <b>photovoltaic</b> power</li> <li>- <b>hydropower</b></li> </ul> </li> <li>- total heat production in <b>heat pumps</b> and utilization of heat pumps.</li> </ul>
COGENPLAnts	<p><b>Cogeneration plants:</b> (Menu 7)</p> <p>One section for each type of plant, containing production and consumption values for each plant of that type:</p> <ul style="list-style-type: none"> <li>- utilized <b>power generation</b> capacity (MW)</li> <li>- utilized <b>heat pump</b> capacity (MW thermal)</li> <li>- power production</li> <li>- heat production in motors, <b>boilers</b> and heat pumps</li> <li>- <b>fuel</b> consumption by type of fuel.</li> </ul>
DHPLANTS	<p><b>District heating plants:</b> (Menu 7)</p> <p>One section for each type of plant, containing production and consumption values for each plant of that type:</p> <ul style="list-style-type: none"> <li>- <b>heat production</b></li> <li>- <b>fuel</b> consumption by type of fuel.</li> </ul>

- INDIVHEAt     **Individual heating installations:** (Menu 7)  
 One section for each type of installation, containing production and consumption values for each installation of that type:
- **heat production**
  - **fuel consumption** by type of fuel.
- PLANTSurvey   A compact **survey of conversion stations** in operation in the different local systems: (Menu 7)  
 For each local system the types of heat supply installations in use (cogeneration stations; district heating stations; individual boilers) and the fuels used in the installations are indicated.

Results from the comparative scenario analysis programs

- *COMPARE (SESAM90)*
- *MAINTABS (SESAM91)*
- *ANALYSIS (SESAM92)*
- *DIFF*

COMPARE.txt   Produced by the **COMPARE** (SESAM90) program. Contains main results, year by year, for a number of scenarios (max. 6) in parallel columns.

Section 1:     Absolute values

Section 2:     Relative values (relative to the first year)

MAINTAB1.txt and

MAINTAB2.txt   Produced by the **MAINTABS** (SESAM91) program. Contains arrays of main result tables:

- electricity consumption
- heat consumption and heat from individual solar absorbers
- power from geophysical power sources
- consumption of local fuels (biomass and combustible waste)
- fossil fuel consumption
- SO<sub>2</sub> emission
- NO<sub>x</sub> emission
- CO<sub>2</sub> emission
- fuel based power generation
- power import/export
- heat generation
- power conversion in the ECTS (in heat pumps and electrolytic converters)
- utilized power generation capacities (geophysical and fuel based)
- max. electricity consumption rate (MW)
- electrical appliances: stock development and consumption development (index)
- building stock and heat consumption: development in total floor area and development in net heat consumption (index)
- development in industrial production volumes
- development in transportation volumes.

In the MAINTAB1 files, each of these tables contains results for one scenario for all scenario years.

In the MAINTAB2 files, each of these tables contains results for one year for a number of scenarios (max. 6). Thus, the MAINTAB2 tables can be inspected for comparison of main results for a number of different scenarios.

In addition to the MAINTAB1 and MAINTAB2 files, the MAINTABS program produces two corresponding files: GRAPH1.txt and GRAPH2.txt with the same contents formatted for transfer to graphic display programs.

ANALYSIS.txt Results from comparative differential scenario analyses carried out by the **ANALYSIS** (SESAM92) program. The analysis computations may comprise 40 scenarios selected from one or more scenario tables.

Section 1: For each scenario: total CO<sub>2</sub> emissions and economic costs during the years covered by the scenario computations.

In the table the scenarios are sorted by total CO<sub>2</sub> emission, the scenario resulting in the highest emission at first, the one with the lowest emission at last.

Section 2: Influences on **fuel consumption and CO<sub>2</sub> emission** of changes in macro-variable values:

Section 2.1: changes in heat consumption for **room heating and hot water**

Section 2.2: changes in **process heat** consumption.

Section 2.3: changes in **electricity** consumption

Section 2.5: changes in available **local fuel quantities**

Section 2.6: changes in power generation in **windmills**

Section 2.7: changes in power generation in **photovoltaic panels**

Section 2.8: changes in heat production in **solar panels**

Section 2.9: changes in electricity supplied from **hydropower** stations

Section 3: Influences on **economic costs** of changes in macro-variable values.

Sections 3.1 - 3.9: corresponding to sections 2.1 - 2.9.

Each table contains values for the three hardware price development scenarios and the three fuel costs development scenarios specified in the ECONCOST document.

Section 4: **Total economic costs** for each scenario.

Results for:

- discount rate zero

- positive discount rate chosen by the user

- the three fuel price development scenarios

- the three hardware price development scenarios.

Section 5: Ratios of **CO<sub>2</sub> emission reductions** to additional **economic costs**.

Sections 5.1 - 5.9: corresponding to sections 2.1 - 2.9.

Each table contains values for the three hardware price development scenarios and the

three fuel costs development scenarios specified in the ECONCOST document.

ANADETAILS **Analytical details**, produced by the **ANALYSIS** (SESAM92) program. Detailed accounts of changes in fuel consumption and emissions caused by changes in macro-variable values.

TOTALS Produced by the **ANALYSIS** (SESAM92) program. Results from **several scenarios (max. 40) in parallel columns:**

Total fuel consumption (by type of fuel) and emissions (SO<sub>2</sub>, NO<sub>x</sub> and CO<sub>2</sub>) for

- transportation and
- stationary plants and installation.

Total economic costs:

- fossil fuel costs
- local fuel costs
- electricity import costs/export incomes
- renewable energy sources: investments and operation
- the ECTS: investments and operation
- buildings: thermal insulation, heating installations, etc.
- electrical appliances: costs of quality-mix improvements.

Section 1: Only accumulated quantities and costs for the entire scenario period.

Section 1.1: Transportation, fuel consumption and emissions

Section 1.2: Stationary plants and installations, fuel consumption and emissions

Section 1.3: Fuel consumption and emissions, total

Section 1.4: Economic costs.

Section 2: Quantities and costs for intermediate scenario periods also.

Sections 2.1 - 2.4 correspond to sections 1.1 - 1.4

SCENVIEW produced by the **ANALYSIS** (SESAM92) program, gives an **overview of the development of main consumption and production values (macro-variable values), CO<sub>2</sub>-emissions, and economic cost** in the scenarios selected for comparison. The first tables show the values year by year for all the scenarios. Below these comparison-tables, the development is shown for each scenario by itself.

DIFFERENCES produced by the **DIFF** program (no. 94 on the menu).

Pair-wise comparisons of scenarios as regards total fuel consumption and CO<sub>2</sub> emission.

Results from the economic costs computation program COSTS (SESAM100):

COSTShfd h, f and d are digits:  
h: hardware price scenario (1, 2, or 3)  
f: fuel price scenario (1, 2, or 3)  
d: discount rate, percent  
Examples: COSTS227 COSTS135  
h, f and d are chosen when the SESAM100 program is started up.

The file contains a table showing the computed **economic costs year by year** for one scenario:

- investments and re-investments (not including insulation of buildings)
- depreciation of capital goods
- maintenance costs
- fuel costs and costs of electricity import(+ )/export(-)
- insulation investments in buildings
- costs of quality-mix improvements of electrical appliances

ECOREhfd h, f, d: as for COSTShfd.  
Summary of Economic Results for one scenario.

**Energy supply costs:**

Investment, re-investment, and operation&maintenance costs in

- the system of energy sources (wind, solar, biomass)
- the energy conversion and transmission system (collective energy conversion stations; district heating and gas networks; individual boilers and mini-cogeneration units; heat supply installations in buildings)
- fuel costs.

**Costs of energy saving measures** in the end-use system:

- heat saving measures (insulation of buildings, etc.)
- electricity saving measures (improvement of the quality-mix of electrical appliances)