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Energy Efficiency Scenario 1990-2010 for the European Union: Results from the MIDAS Model.

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Energy Efficiency Scenario for the European Union[1]

Results from the MIDAS Model [2]

1. Introduction

This report presents work of NTUA, for EC DG-XI, in preparing an energy system scenario for all EU-15 member-states for the period 1995-2010.

The scenario, as defined, would be based on ad hoc assumptions reflecting acceleration of energy efficiency gains in all demand and supply sectors. The scenario, called "Efficiency" hereinafter, would be compared to a baseline projection, based on the Conventional Wisdom scenario, as prepared for the Energy 2020 study of DG-XVII.

The purpose of the exercise is twofold:

investigate whether accelerated energy efficiency gains could, taken alone, provide a significant decoupling of useful energy demand growth from CO_2 emissions in the EU-15

analyse the implications for acidification policy, after evaluating SO2 and NOx concentrations through the use of the RAINS model[3] that operates starting from the evaluation of energy related emission[4] of acid rain pollutants.

The output of the MIDAS scenario takes the form of a set of detailed energy balance sheets, power generation balances, refining, gas and new fuel supply balances, investment programs and results about costs and prices of energy. The information is provided separately for each member-states and, after aggregation, at the EU-14 (except Luxembourg) level.

2. Definition of the Policy Case

2.1. Introduction

The assumptions regarding acceleration of energy efficiency gains in energy demand and supply are based on information and considerations that are extraneous tot he MIDAS model. In other words, the improvement in the efficiency scenario is not an effect of a policy incorporated in the model run assumptions. These gains could be a result of policy, such as regulation or increased prioritization of environmental implications as perceived by economic agents, but this policy is not reflected in the values of exogenous parameters of the model run. The gains are not, therefore derived from any change of relative prices or taxation etc.

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[1] The views expressed in this paper do not engage the European Commission. The paper and the numerical results must be considered as an outcome of scientific research and are subject to modelling and data limitations. They also are subject to revision.

[2] The MIDAS model, sponsored by the European Commission DG-XII/F1 (Mr. P. Valette) and DG-XVII/A2 (Mr. K. Leydon) has been constructed by NTUA. MIDAS Version 5.1 has been also used in the "Scenarios 2020" study of DG-XVII.

[3] The application of the RAINS model is a task of IIASA.

[4] The accounting for the emission of acid rain pollutants, derived from the MIDAS scenarios, is undertaken by CoHerence through the Hector model.

In this sense, the MIDAS model does not provide any validation of the results of the efficiency regarding energy efficiency gains. The model does provide, however, consistency checking, as the ad hoc changes in energy consumption are affecting energy supply, which provides new energy prices after readjusting, that further influence energy demand. For example, the ad hoc assumptions about electricity savings in demand, imply a model-driven estimation of the electricity load curve (shape and area), leading to a readjustment of investment plans, plant dispatching and electricity pricing.

We notice, nevertheless, that the indirect effects are rather small, in magnitude, compared to the direct effects implied by the ad hoc assumptions on energy efficiency gains. The results should, therefore, mainly attributed to the extraneous assumptions.

The methodological issue is the empirical validation of the accelerated energy efficiency gains in the demand sectors. As it is known, several approaches are advanced in the literature about this issue.

The so-called “bottom-up” approaches, start from detailed technico-economic evaluations that provide evidence about the existence of cost-effective energy efficiency options.

Cost-effectiveness is defined at the energy user level, as those technological options that exhibit negative or even a reasonable break even. In this sense, economic agents have to choose these options when deciding about equipment replacement. The velocity of energy efficiency gains, should then, according to this approach, depend on the rates of equipment replacement. The cost-effective evaluation is a dynamic process, as technology progresses over time: new technologies reaching commercial maturity may change the list of options that become cost-effective.

To further analyse the technology choice issue, some analyses use a categorisation of technological options that extend the cost-effectiveness concept. They define an economic and a technical potential of technology improvement. The economic potential goes beyond cost-effectiveness, after accepting an internal rate of return of the investment that is comparable to market rates of return. The technical potential is defined along the concept of best available technology that the economic agent would adopt. Obviously, the range of results, from cost-effective options up to best available technology, can be large.

Other approaches, called “top-down”, emphasize on behavioural characteristics of economic agents. Technology progress, inducing accelerated energy efficiency gains, means in economic terms, increasing productivity of energy.

This further implies, that after a transition period, the energy bill will decrease as a percentage of total cost, either for the producer (in terms of cost of commodity production) or the consumer (in terms of total consumption expenditure).

Under these circumstances, it should be expected that there will not be a complete shift of cost gains from energy to other, non energy consumption or production factors. There will be new uses of energy (for example new uses of electricity) that will lead to higher than expected energy demand.

In other terms, the assumption of bottom-up approaches that neglects the effect of energy productivity improvement on the demand for useful energy, is removed in the top-down approaches. The latter implicitly accept that increased energy productivity will lead to increasing useful energy demand. The net effect, combining efficient use of energy with higher useful energy demand, is expected to be negative for total final energy demand, but significantly lower in magnitude, than expected as a resulted from the bottom-up approaches.

Top-down approaches attempt to capture those behavioural effects by using reduced form equations that involve econometrically estimated elasticities. The behavioural equations can be complementary to analytical engineering representations of technico-economic factors that simulate technology choice. In such complex energy models, often called engineering-economic models[5] for energy, one can combine behavioural and analytical formulations, so as to combine the bottom-up with the top-down approaches.

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[5] Models such as NEMS, IFFS of the USA DOE, as well as MIDAS and PRIMES for the EC, enter this category.

In this exercise, we introduce assumptions derived from bottom-up studies as changes in some of the parameters of the demand side econometric equations of MIDAS.

2.2. Assumptions in the “Efficiency” Scenario

As explained, in the previous section, the ad hoc assumptions about accelerated energy efficiency gains in the “efficiency” scenario, can be justified only on the basis of extraneous, to the MIDAS model, information.

If we consider a range of improved technology options for energy use that extends from cost-effective options up to the best available technology level, generally our estimates are close to the first: our assumptions correspond to economically feasible solutions.

We put emphasis on the combined effects of progress made in the following:

- more efficient electric appliances in the domestic sector
- more severe regulation regarding thermal integrity of buildings
- more accelerated restructuring in industry, away from basic processing and in favour of higher value added products (and less energy intensive), also facilitated by accelerated recycling of raw materials, such as aluminium, plastics, glass and paper
- higher penetration of combined heat and power systems in industry
- accelerated penetration of more efficient processes in industry
- more severe regulation about specific consumption in road transports.

The following table shows indicative values of energy efficiency improvement assumptions. The column under the heading “base case” corresponds to the econometrically estimated elasticities[6], relying on past trends over the 1970-1992 period.

Table 1 *Cumulative Specific Consumption Improvement*

	Base Case	*Efficiency*	
	1995-2020	1995-2010	1995-2020
Households			
Dryers	12.1%	30.4%	35.4%
Dish Washing	11.7%	28.5%	33.5%
Lighting	42.4%	55.3%	60.8%
Refrigerators	4.2%	36.5%	44.3%
Television	9.2%	34.8%	39.9%
Washing Mashines	11.7%	33.1%	40.2%
Thermal Integrity of Buildings			
	1995-2020	1995-2010	1995-2020
	6.9%	10.0%	17.7%
Energy Efficiency Gain in Industrial Processing			
	1995-2020	1995-2010	1995-2020
Building Materials	3.0%	12.7%	14.6%
Chemicals	3.0%	15.4%	17.7%
Iron & Steel	4.2%	14.1%	16.0%
Non Ferrous	5.7%	21.2%	23.9%
Other Industries	3.8%	17.5%	20.0%
Paper and Pulp	7.4%	15.5%	17.1%
Specific Consumption in Cars			
	1995-2020	1995-2010	1995-2020
	0.1%	2.3%	2.8%

Fort the “efficiency” scenario we retain the assumption corresponding to the column with heading “efficiency” for the 1995-2010 period.

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[6] We refer to the MIDAS econometric estimation procedure that combined time-series and cross-section data.

For industry and transports, the figures in the above table refer to overall energy efficiency gains, either due to process improvement or to behaviour. There are additional gains in the combustion of fuels, that are summarised in the table below, referring to the 1995-2010 period:

Table 2 **Cumulative Efficiency Gains in Combustion of Fuels**

	Domestic		Industry	
	Base	Efficiency	Base	Efficiency
Gas	1.08%	2.18%	6.96%	14.58%
Oil	0.92%	1.85%	1.42%	2.90%
Solids	0.67%	1.35%	1.27%	2.57%
	Transports			
	Base	Efficiency		
Gasoline	2.37%	5.00%		
Diesel	0.47%	0.94%		
Biofuels	1.42%	2.91%		

Additional improvement is carried through the higher penetration of industrial cogeneration of heat and power and district heating for domestic use.

Our ad hoc assumption in this matter, relates to model parameters that express the sensitivity, or inertia, of consumers in choosing a cost-effective, but still new, fuel. While, the unit net cost of heat is for the consumer lower than that of competitive fuels, the consumer in the base case is reluctant about shifting fuel mix in favour of cogenerated heat. In the efficiency scenario, however, he is more willing to adopt the advanced, hence cost-effective, solution.

In addition to the ad hoc assumptions regarding energy efficiency gains, we introduce in the efficiency scenario a rather small change of the energy excise taxation. This is based on Case-1 of the EC new proposal[7] on revising the minimum levels of excise taxation for energy fuels for end-consumers. Table 3 shows the new EC proposal that is likely to be applied after 1998, while in the column for 1996, the table shows the present level of minimum excise taxes.

Table 3 **Proposal for Minimum Excise Taxes as in 27 September 1996**

		ECU/Specific Unit			
	Unit	1996	1998	2000	2002
Motor Fuels					
Gasoline	klt	337	450	500	557
Gasoil	klt	245	343	393	450
Kerosene	klt	245	343	393	450
LPG	tn	100	174	224	281
Natural Gas	m3	100	174	224	281
Comm/Res. Uses					
Gasoil	klt	18	32	36	40
Kerosene	klt	18	32	36	40
LPG	tn	36	42	47	52
Natural Gas	m3		10	23	39
Heating Fuels - Industry					
Heating gas oil	klt	18	21	23	25
Heavy fuel oil	tn	13	18	23	27
Kerosene	klt		8	16	25
LPG	tn		10	21	32
Natural Gas	m3		8	16	24
Petroleum Coke	tn		7	14	21
a) Hard coal	tn		5	11	17
b) Low grade anthracite	tn		4	8	12
c) Sub-bituminus coal	tn		3	9	9
Coke	tn		5	11	17
a) Opencast Lignite	tn		2	4	5
b) Lignite briquettes	tn		4	9	14
c) Deep mined lignite	tn		3	7	11
Peat	tn		2	4	6
Electricity	MWh		1	2	3

The minimum excise taxes are applied in those cases, countries and sectors, where the present level of national excise taxation is below the minimum level. As in several cases, the national levels already are significantly higher than the minimum levels, the new proposal has rather limited implications on energy prices.

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[7] The proposal is under discussion within the European Commission.

Our detailed estimates by using MIDAS[8] indicate that at the EU average level, the change of excise energy taxation implies a rather small increase of energy costs by sector (see Table 4). Industry is generally more affected, as this sector was less taxed before. In transports, higher energy costs are mainly attributed to higher taxation of diesel oil. The domestic sector is less affected, bearing a rather small energy cost increase.

The structure of the new tax is such that the cost of solid fuels is significantly increasing in Case-1 (from 10% to 25% in 2010). It is noticeable that also the end-user price of natural gas is affected under new taxation: its price rises by 3% to 11%, in both industrial and domestic energy uses. The price of oil fuels is not much affected in industrial and domestic sectors, bearing an average cost increase of 1% or 2%. Electricity also is more taxed within the new scheme, leading to a price increase ranging between 1% and 4%. In percentage terms, industrial use of electricity is more affected than the domestic use.

Because of the tax scheme definition, the implications on energy costs differ by country. Under Case-1 countries that had a low level of pre-existing energy taxation are more affected. For example, this is the case of the industrial sector of UK, the transport sector of Spain or the domestic sector of Belgium. On the contrary, countries having high pre-existing taxation are less affected, as for example Denmark.

Table 4 **Effects of Case-1 Minimum Excise Taxation**
in % change of average energy prices in EU-15

	2000	2010
Industry	2.7%	4.1%
Domestic	1.4%	2.4%
Transports	1.6%	2.8%
Power Generation	0.0%	0.0%

The price changes, induced by the tax, exert effects on energy demand that are acting additionally to the ad hoc assumption about energy efficiency gains. We estimate, however, that the price effects are rather small regarding overall energy efficiency, as we have evaluated, through MIDAS. For example, the autonomous effect of Case-1 taxation, compared to a continuation of taxation as standing in 1996, leads to an overall decrease of final energy demand of -0.7% in 2010 at the EU-15 level. The autonomous effects on fuel mix are more significant, leading to -9% decrease of the demand for solids, -0.5% for oil, -0.1% for gas and -0.3% for electricity. The change in fuel mix contributes to an overall decrease of CO2 emissions of -0.9% in 2010 (EU-15), exclusively due to the additional excise energy taxation introduced by the Case-1 scheme.

2.3. Discussion of Assumptions on Energy Efficiency Gains

Our assumptions as presented in Tables1 and 2 stand at the lower end of estimates of potential energy efficiency gains, as found in several “bottom-up” studies. Our assumptions are considerably lower than the potential gains estimated along the “best available technology” concept.

For example, in the residential sector, Table 5 shows estimates of potential efficiency gains in the use of electricity based on technological considerations. If adopted, these could lead to electricity savings higher than 65% in average, without considering more advanced technologies not fully proven at present. Bottom-up studies indicated that the total net cost of such improvement, corresponding to the best available technology in the residential electricity use, could be compared to a higher electricity price of the order of 35-40% per kWh.

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[8] This evaluation was presented as a different report to the DG-XI.

Table 5 *Cumulative Specific Consumption Improvement*

	Extrapolation of recent trends	*Best Available Technology*	*Advanced Technology*
Households			
Dryers	41.0%	67.0%	86.0%
Dish Washing	42.0%	57.0%	76.0%
Lighting	25.0%	70.0%	88.0%
Refrigerators	31.0%	65.0%	82.0%
Television	43.0%	64.0%	79.0%
Washing Mashines	59.0%	72.0%	81.0%

Compared to Table 5, our assumptions lie far below technical potential.

Similar considerations hold for the other sectors. For industry, the bottom-up estimates suggest that there exist a potential of the order of 45-60% of energy efficiency gains, equally distributed in process energy and cross-cutting energy uses (e.g. motor-driven equipment). Our assumptions for industry also lie far below these estimates (see Table 6).

Table 6 *Cumulative Specific Consumption Improvement*

	Technical Potential	
	Fuel Savings	**Electricity Savings**
Building Materials	43.0%	30.0%
Chemicals	22.0%	5.0%
Iron & Steel	15-72%	5-15%
Non Ferrous	"	"
Other Industries	40.0%	21.0%
Paper and Pulp	30.0%	15.0%

2.4. Other Assumptions in the Efficiency Scenario

Regarding the energy supply side, the efficiency scenario incorporates some of the Forum scenario assumptions, as follows:

- higher penetration of electricity producing renewable energy forms (wind, solar, geothermal)
- lower cost of biomass supply

The efficiency scenario employs the same discount rate as the Base Case and all technico-economic characteristics of equipment and plants in the supply side. There are no particular restrictions on nuclear energy, in the countries that, theoretically, could adopt that form of energy also in the future.

2.5. Definition of the Base Case

The base case is based on the Conventional Wisdom scenario. The only difference regards excise energy taxation that has been adjusted to the actual levels for 1996. This correction was necessary to ensure comparability of this scenario to the Case-1 excise taxation. There is no policy for additional taxation in the Base Case except an increase of excise levels along inflation rates, by country.

3. MIDAS Results

The present report is accompanied by an Appendix presenting the detailed numerical results. In this report we limit discussions at the aggregate EU-15 level.

The efficiency scenario achieves an overall reduction of final energy demand of -6.9% in 2010 (-1.8% in 2000). The reduction is more important in industry (-10.6%), followed by transports (-6.8%) and the domestic sector (-4.2%). The percentage changes are relative to the same year figures of the base case.

The fuel mix within final energy demand, also changes. Solids lose in share, bearing a decrease of -21.4% in 2010, in terms of final energy demand for solid fuels. A decreasing trend is also observed for the final energy demand for oil products (-8.7% in 2010, -2% in 2000), but also for natural gas (-6.8% in 2010). The overall effect on end-user electricity demand is noticeable: electricity savings of -9.7% are achieved in 2010 (-2.2% in 2000). The demand for cogenerated or distributed heat increases in the efficiency scenario (by 11.8% in 2010), leading to a higher share of distributed or cogenerated heat than that of solid fuels.

The drop of electricity demand, compared to the base case, leads to a restructuring of power generation investment plans, as projected by MIDAS. The electricity savings are such that the average load factor decreases (by -2.6%), indicating the need for more peak and medium load devices rather than base load plants. This leads to less investment in nuclear energy plants (10 GW less in the 1990-2010 period), but also to considerably less investment in advanced coal technologies (24 GW less). Instead, investment in gas fired combined cycle plants (-8.7%) decrease less than total capacity expansion (-18%). Investment in renewable energies is increased, by adding about 10 GW of additional capacity, compared to the base case.

Regarding the use of fossil fuels in power generation, natural gas gains in share (+1%), while the use of solid fuels is decreased by -17% in energy terms. The use of biomass also decreases, while oil products are more used in power generation, even though kept small in magnitude.

Net imports decrease by about 10% in 2010, leading to an improvement of import energy dependency.

The implications on CO2 emissions are noticeable. Emissions are reduced by 9.6% in 2010, compared to the base case, while they are stabilised over the whole projection period. In the base case, there was an increase of CO2 emissions, continuously after 1996, reaching in 2010 a level higher by 9.9% than that of 1990. The cumulative gains in terms of CO2 emissions are therefore impressive.

4. Conclusions

This brief report showed the attractiveness of energy efficiency gains for the achievement of environmental objectives.

The MIDAS model and the nature of the scenario case, as defined in this exercise, did not allow for an evaluation of the overall costs of the energy efficiency gains and did not address the issue of policies evaluation that would be necessary to achieve these gains. We expect to provide soon such an insight, by using the PRIMES energy model.

5. Appendix 1: The MIDAS Energy System Model

5.1. Status

MIDAS is a large-scale energy system planning and forecasting model. It performs dynamic simulation of the energy system, which is represented by combining engineering process analysis and econometric formulations. The model is used for scenario analysis and forecasting. Each national application of MIDAS (version 5.1) is a simultaneous system of more than 10,000 equations solved dynamically over a period of 20-30 years. The MIDAS model building project was funded by the Joule Programme of DG XII and by DG XVII, The European Commission.

Version 5.1 (1994) is fully operational. At present 16 models for EU and EFTA countries are available, namely for UK, Germany (unified), France, Italy, Spain, Belgium, Netherlands, Denmark, Ireland, Portugal, Greece, Austria, Sweden, Finland, Norway and Switzerland. Version 5.1 includes annual forecasts for 4 DG-XVII scenarios, that is Conventional Wisdom, Battlefield, Forum and Hypermarket, at an annual path for 1994-2020. Also, the new model of the Electricity module of MIDAS is available as a stand alone model for 16 European countries.

5.2. Framework

MIDAS covers the whole energy system, including energy demand by sector and fuel, power generation, oil refineries, natural gas, solid fuels production, imports and energy market prices. The model ensures, on an annual basis, the consistent and simultaneous projection of energy demand, energy supply, energy pricing and costing, so that the system is in both quantity and price-dependent balanced. A closed-loop iteration is established which converges on an annual basis, so to provide a consistent simulation of energy demand, supply and prices consistency. The results within a year are influencing dynamically the conditions in the following year, through anticipation, stocks, existing capacities and behavioural inertia.

The model's output is a set of time-series over the forecasting period (at present 1992-2020), consisting of complete and detailed EUROSTAT energy balances; energy price catalogues, before and after taxes, by fuel and consumer; supply cost analysis per system, capacity expansion plans (investments), capacities utilisation, CO2, NOx, SO2 emissions, etc.

MIDAS uses input exogenous variables that include international fuel prices, energy fiscal policy, macroeconomic indicators, technical and economic parameters on supply technologies, primary domestic production, emission factors (CO2, SO2 and NOx) per plant and fuel.

5.3. Modelling characteristics

MIDAS consists of the following sub-models:

- Energy demand sub-model. A forecasting econometric system that uses activity variables, technical coefficients and relative energy prices to estimate energy demand and fuel substitutions by sector, at a disaggregated level. The econometric estimations were based on a technique combining panel estimators and cointegration. The model distinguishes between end-uses and considers explicitly technologies for electricity uses in domestic and in transports.
- The electricity generation module follows probabilistic simulation of thermal generation, based on successive convolution of two-stage probabilistic model of plant operation and computes system's LOLP. The module considers 48 different power generation technologies and treats plant-blocks at given typical plant-size. Marginal and total generation costs are computed per load level. Capacity expansion is fully endogenous within the planning module. It considers economic criteria, user-defined priorities, previously decided investment, endogenous decommissioning, special treatment of auto-producers and CHP and the required system's reserve margin.

- New fuel cycles represent a new feature for MIDAS and contain hydrogen production (6 processes), hydrogen use in transport and power fuel cells, hydrogen distribution in gas and/or hydrogen networks, biofuel production (4 processes), biofuel use in fuel cells, biofuel mix with gasoline and diesel oil, biomass production.
- The petroleum refining sector represents an aggregate typical refinery composed of a distillation, a vacuum distillation, a cracking, a visbreaking, a hydrocracking, a disalphalting, a coking and a reforming unit. The model considers explicitly refinery flows and capacity expansion issues for these conversion units. The refinery sub-model proceeds in the adjustment of conversion capacities and the profitable market allocation between imported and domestically produced distillates, so as to meet demand, as addressed by the final demand and the electricity sub-models.
- For the gas system, Midas formulates an allocation problem, searching to meet a dynamically generated gas load duration curve by means of imports of natural gas by pipeline, liquefied natural gas imports, domestic gas production and synthetic gas (gasworks, coke-oven and blast-furnace gas).
- The energy pricing sub-model of MIDAS considers domestic supply costs, international prices, taxes and pricing policy parameters, to compute end-consumer prices of fuels. For electricity and gas, several tariff categories are considered, following EUROSTAT definitions. Import prices and domestic primary production are considered as exogenous.
- Once a balanced projection computed, Midas is complemented with an environmental satellite model. This uses exogenous emission factors to compute emission levels of pollutants by sector and fuel, including CO2, SO2 and NOx.

5.4. Nomenclature of MIDAS 5.1

5.4.1. Fuels

Lignite, Coal, Coke, patent fuels, briquettes of lignite, other solids, crude oil, refinery gas, LPG, naphtha, gasoline, diesel, kerosene, fuel oil, bio-gasoline, bio-diesel, other petroleum products, gasworks, blast furnace gas, coke oven gas, natural gas, distributed gas, distributed hydrogen, electricity, CHP heat, district heat, hydro, solar, wind, geothermal, biomass, waste, hydrogen, biofuels, nuclear

5.4.2. Sectors

Iron and Steel, Non ferrous, Building materials, Paper and Pulp, Chemicals, Petrochemicals, Other industries, Non energy uses, Domestic/Tertiary, Road transports, Air transports, Navigation, Train transports

5.4.3. End-uses

Specific electricity, other energy uses (thermal and other substitutable uses), non energy uses; 8 electricity appliances in domestic demand;

5.4.4. Power generation plants

Lignite, Coal, Gas, Fuel-oil, polyvalent with coal, polyvalent without coal, peak devices, combined cycle gas turbines, nuclear, IGCC, PFBC, ASFBC, topping, (in total 10 new fossil fuel technologies), CHP, biomass combined cycle, fuel oil combined cycle, hydro lakes, hydro ROR, wind, solar, geothermal, small autoproducers, fuel cells.

5.4.5. Refineries

Distillation, vacuum distillation, reforming, cracking, visbreaking, hydrocracking, coking

5.4.6. Natural gas

Pipeline transport, liquefied natural. gas, gas distribution

5.4.7. New fuels, new technologies

Biomass, methanol, passive solar, fuel cells, hydrogen, heat distribution (CHP, district heating), 10 power technologies

5.4.8. Environment

Abatement technologies for SO2, NOx in industrial sectors and power generation, environmental taxes, standards/regulation, pollution permits. CO2 emissions.

5.4.9. Prices

Full set of pre-tax and after-tax prices by end-user for all commercial fuels

5.4.10. Costs

Full average and marginal cost of electricity, gas prices, oil and refining prices, solid fuels supply prices

5.4.11. Investments

In energy supply sectors by plant type and in energy distribution.

5.5. MIDAS Software and Database

MIDAS uses the SOLVER/NTUA software system (version 1.8e) that can support large scale time-series models and provides facilities for data handling, reporting and special Fortran subroutines.

The MIDAS data base comes from the following sources: EUROSTAT Detailed Energy Balances (SIRENE), OECD/IEA Energy Prices and Taxes, EFOM Model DataBase, Eurelectric data, BP database, MURE, FRET and DERE databases of DG-XII, KRONOS (Macroeconomics), EPIC database (power plants) and several national sources for Mining, Refining, Power Generation, Coal Statistics, Natural Gas, Crude-oil production and transmission. Time-series are available for 1960-1993 (energy balances) and 1978-1993 (energy prices). The model data base includes more than 25000 time-series and 15000 parameters (elasticities, costs, technical coefficients).