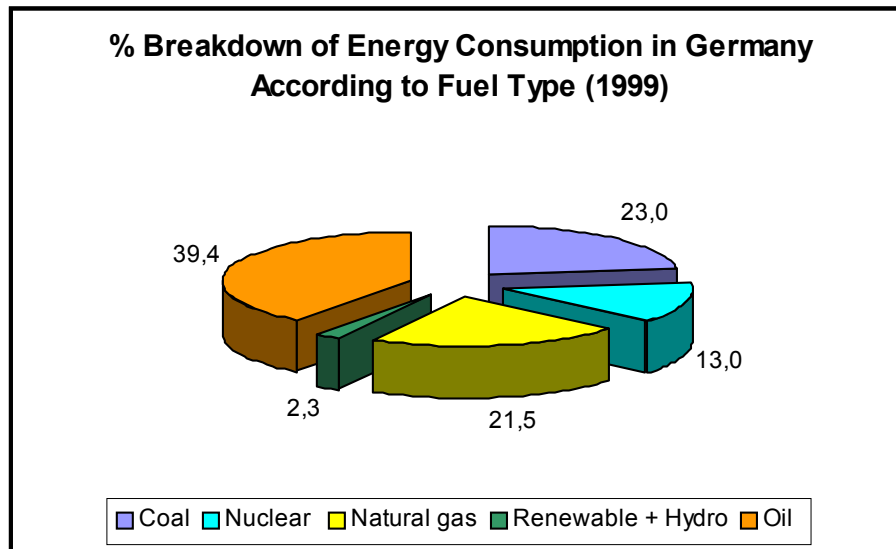


Economic sustainability

►Indicator 5: Energy Security and Energy Trade

German energy consumption has shown a slightly decreasing trend, with consumption reductions from 14, 912 PJ in 1990 to 13, 863 PJ in 1999. In 1999, coal accounted for approximately 47% of domestic energy production in 1999, nuclear power 30%, natural gas 14%, renewable sources (including hydro) 6% and oil 2% (see Figure 5.1).

Figure 5-1



Source: Bundesministerium für Wirtschaft (2001)

Germany is reliant on energy imports from Europe, Norway and CIS countries to meet almost 70% of its energy needs. However, as a result of the creation of a common Energy Market within Europe, and the diversification of import sources from different countries within the common European energy market, reliance on imports is not considered an energy security issue. The fuels imported by Germany include oil, natural gas and hard coal. The current German government has agreed to phase out the use of nuclear reactor, primarily due to public and political concerns regarding nuclear waste disposal. Renewable energy sources are strongly supported by laws forcing private grid operators to buy renewable electricity at government-imposed prices. As stated above, the federal government does not provide net subsidies for renewables, as the subsidies are more than compensated for by eco-taxes. Currently, Germany's main renewable resource is hydro and wind power and the German government is looking to further develop wind resources, and the vast biomass potentials. Research and development is also increasing for geothermal, and solar-thermal electricity.

The HELIO International indicator 5 is used to assess whether Germany promotes sustainable energy use through its import policy. In other words whether imports of energy generated from fossil fuels are decreasing over time (and if the import of energy from renewable energy sources is increasing). However, for countries within Europe, this vector value can be misleading, since countries within the European Energy market are working to achieve sustainable development for Europe through an integrated energy policy which encourages countries to import cleaner energy from their neighbours. An improvement in emissions for some countries might simply mean using cleaner fossil fuel rather than renewables in the first instance. As a result, a country such as Germany may be more dependent on fossil fuel imports than other countries, and yet the overall

balance within Europe would show a positive trend towards sustainable energy systems. Due to this issue, the authors of this report strongly recommend that in the next HELIO International Observer reports, a section reviews the European energy market as well as assessing individual European countries.

In order to calculate the vector in the star the following data as presented in Table 5.1 was used:

Table 5-1. Data used For Assessing Sustainability of Energy Imports in Germany

	1991	1999
Total Energy Imports from Non Renewable Sources (PJ)	9,253	10,399
Percentage of Non Renewable Energy Consumed that is Imported (PJ)	63%	73%
Total Energy Imports from Renewable Sources (1000 t)	0	0
Total Energy Consumption (PJ)	14,610	14,194

Source: Bundesministerium für Wirtschaft : Wochenbericht (2001)

Calculation of Vector for Indicator 5

Data for E. Germany was not available for 1990 and therefore figures for 1991 have been used. The following calculation is defined by HELIO International for countries that, like Germany, are net energy importers:

X_{im} = total non renewable energy imports

Y_{im} = total non renewable energy consumption

$$I = (X_{im} \div Y_{im})$$

$$I (1991) = 0.63$$

$$I (2000) = 0.73$$

►Indicator 6: Burden of Energy Investments

The indicator 'Burden of Energy Investments' compares government expenditures in non-renewable energy supply to total Gross Domestic Product as a measure of the burden of energy development in the economy. This indicator illustrates how public funds spent in the energy supply sector are used to encourage cost effective renewable energy supply and end user efficiency.

The calculated vector value for this indicator considers national expenditures and investments in non-renewable energy sources. This includes expenditures for R&D, energy supply, transmission and distribution systems, power plant re-construction, and removal of nuclear waste. Regional and municipal investments were not included in the vector calculation since no disaggregated data was available at this point in time.

The vector is characterised as follows:

1 is 10 % of federal government expenditures in non-renewable energy as a fraction of GDP

0 is 0 % of federal government investment in non-renewable energy as a fraction of GDP

Table 6-1. Data for calculating the vector of burden on energy investments

	1991	1993	1995	1997	1999
Federal R&D expenditures [Million DM]	871.2	659.0	524.0	496.7	544.0
In coal, other fossil fuels and nuclear					
GDP [Billion DM]	3,346.0	3,383.8	3,522.9	3,601.0	3,728.2

Sources: Zahlen und Fakten (2000), Bundesministerium für Wirtschaft und Technologie, Federal Report (2000) Bundesministerium für Bildung und Forschung

Calculation of Indicator 6 Vector Value

The burden of government investment in non-renewables is calculated by using the formula

$$I = (X / Y) * 10$$

Where

I represents the vector value

X represents government investments in non-renewable energy and

Y represents the GDP

The vector value goes from zero to 10% of GDP with zero being the sustainability objective. The vector value is calculated as the fraction of government investment in non-renewables multiplied by 10. The actual vectors for 1991 and 1999 are follows:

$$I_{(1991)} = (0.8712 \text{ billion DM} / 3,346.0 \text{ billion DM}) * 10 = \mathbf{0.0026}$$

$$I_{(1999)} = (0.544 \text{ billion DM} / 3,728.2 \text{ billion DM}) * 10 = \mathbf{0.0015}$$