

## Assessment of automotive fuels

G. Isenberg \*

*Daimler-Benz, Research Center Ulm, FT1 / E, Wilhelm-Runge-Straße 11, D-89013 Ulm, Germany*

Accepted 28 June 1999

### Abstract

Energy demand all over the world increases steadily and, within the next decades, is almost completely met by fossil fuels. This poses increasing pressure on oil supply and reserves. Concomitant is the concern about environmental pollution, especially by carbon dioxide from fossil fuel combustion, with the risk of global warming. Environmental well-being requires a modified mix of energy sources to emit less carbon dioxide, starting with a move to natural gas and ending with the market penetration of renewable energies. Efforts should focus on advanced oil and gas production and processing technologies and on regeneratively produced fuels like hydrogen or bio-fuels as well. Within the framework of an industrial initiative in Germany, a process of defining one or two alternative fuels was started, to bring them into the market within the next years. © 1999 Elsevier Science S.A. All rights reserved.

*Keywords:* Fossil energy reserves; Global warming; Urban air quality; Alternative fuels; Renewable energies

### 1. Transportation activities depend on fossil fuels

The economic well-being of all countries depends on reliable affordable supplies of energy.

At present, about 90% of this energy supply is guaranteed by fossil energy sources (Fig. 1).

A combination of population growth and economic development especially in (Southeast) Asia and Latin America is driving a rapid expansion of world energy use (Fig. 2).

Growing energy consumption gives rise to the following.

- Increasing pressures especially on world oil supplies and reserves (Fig. 3). Possible result: The end of cheap oil is coming within the next 10–15 years; global production of conventional oil begins to decline sooner than most people think. It will almost certainly create economic and political tensions.

- Increasing environmental pollution especially by the significant increase of world wide emissions of carbon dioxide from fossil-fuel combustion risking global warming.

So officials from BP, Shell, Texaco and Sun Oil suggested recently that the companies must begin to address the problem of climate change.

### 2. The need for an agreed-on non-fossil fuel

The growing recognition of environmental impacts of energy use is adding a new dimension to energy policy.

The environmental well-being — from abating the risk of global warming to improving urban air quality — requires a modified mix of energy sources to emit less carbon dioxide and other pollutants than does today's mix. This process may start with a move for gas and has to end in the market introduction/penetration of renewable energies.

The trend in growing dependence on third world countries especially for oil supply requires severe activities for safe supplies of oil or alternatives to it (Fig. 4).

Thus, increasing attention must be directed to improvements in technologies of energy supply and use and to alternatives to oil.

Energy research and development programs have to be completed and focused on (to give some ideas):

- Advanced oil and gas production and processing technologies;

\* Tel.: +49-731-505-2462; fax: +49-731-505-4211

Energy Consumption about 12.6 billion tons of coal energy equivalent		Energy Consumer	
Oil (51% Transportation)	39.4%	Domestic	22.9%
Natural Gas	21.2%	Transportation (98% Oil)	20.6%
Coal	23.9%	Industry	37.8%
Nuclear Energy	6.3%	Power Generation	18.7%
Hydropower	2.7%		
Others			

Fig. 1. The present situation of energy supply and consumption. The main energy source is oil with a share of contribution of about 40% especially for transportation activities (depending on oil at 97%–98%).

- Advanced coal technologies including liquefaction (coal-based fuels);
- Development and market introduction of most efficient technologies of energy supply and use for instance of fuel cells; for stationary and mobile applications;
- Regeneratively produced fuels like hydrogen or bio-fuels (methanol, ethanol).

For reasons of economy, environment and national security means must be found to meet the economic aspirations and associated energy needs of all the world’s people while protecting the environment and preserving peace and stability of energy supply.

The assessment of alternative fuels has to consider full fuel cycle efficiencies (from “well to wheel”), life cycle

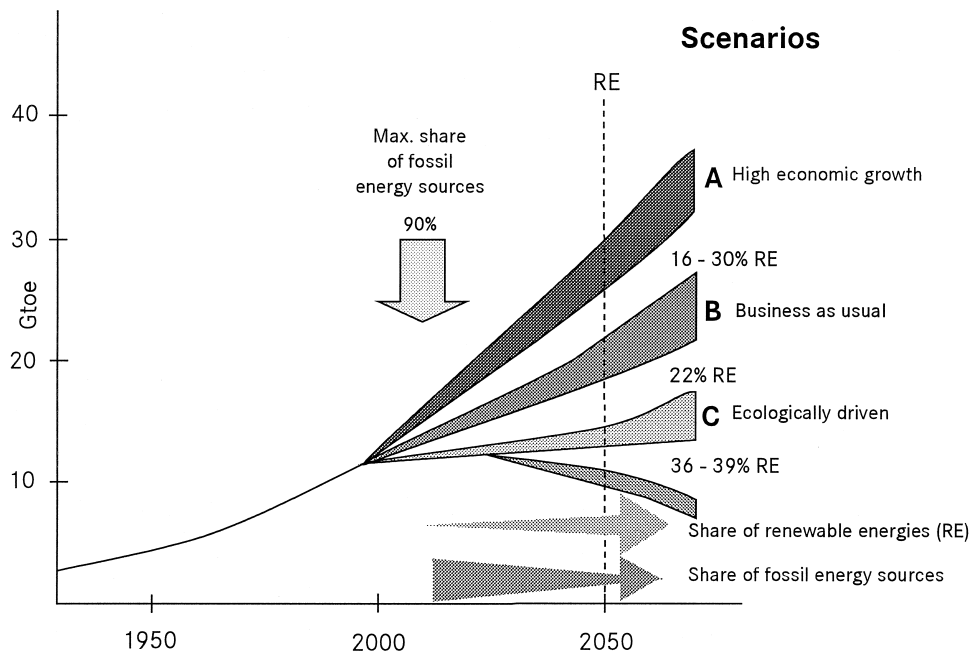


Fig. 2. Results of different scenarios showing a steady growth in global energy demand ensured within the next decades almost completely by fossil fuels. Renewable energies will contribute significantly only after 2030.

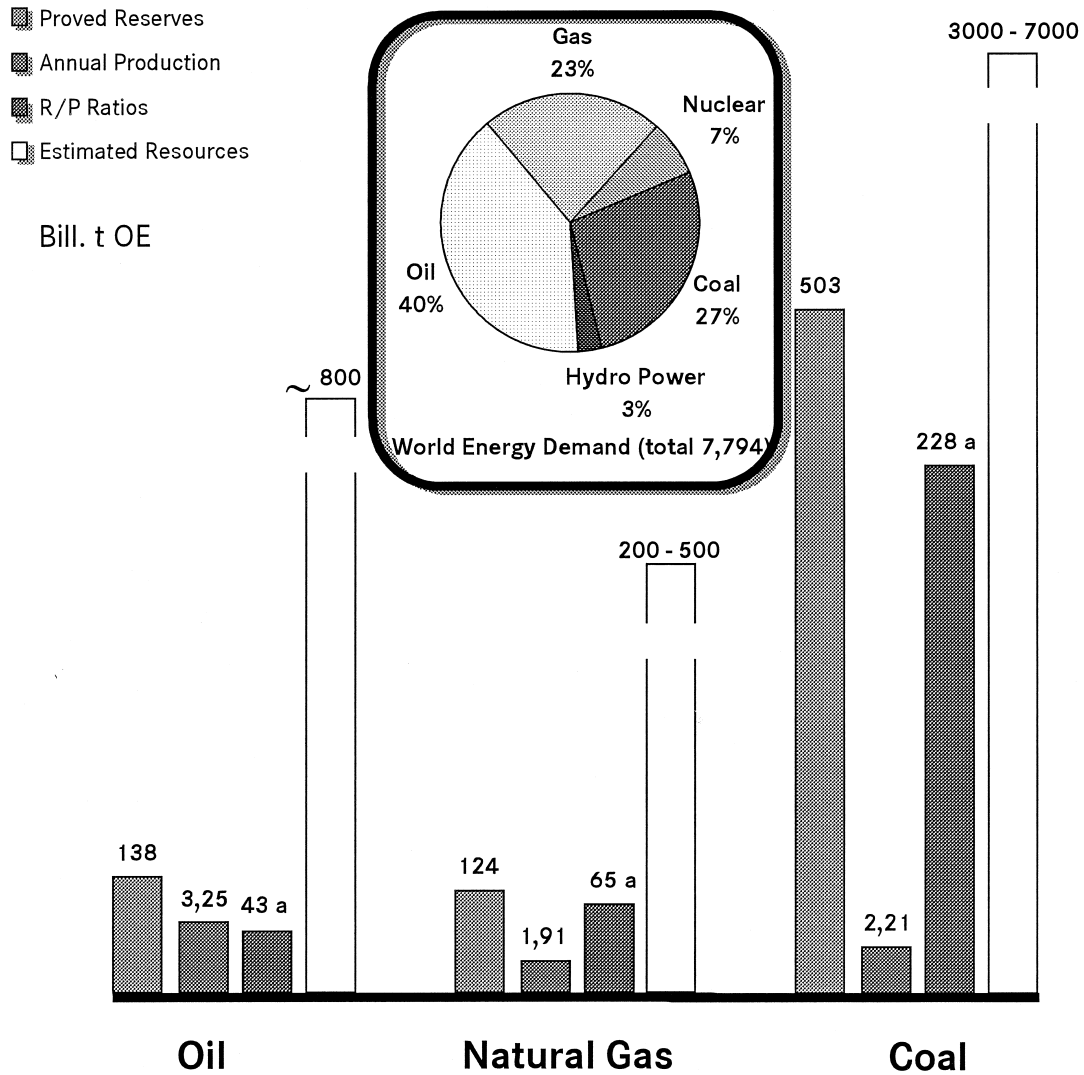


Fig. 3. The situation of fossil energy reserves (well known and to be exploited economically) and resources (67% of secure oil reserves are located in Middle East, a politically troubled area, 77% in OPEC countries). The present OPEC contribution to oil supply is less than 40%.

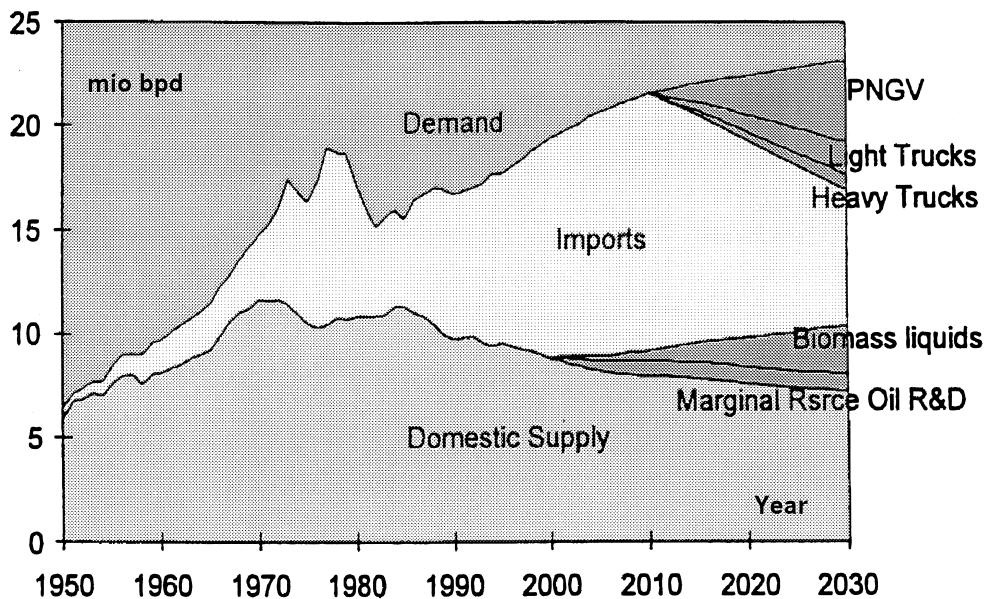


Fig. 4. US situation in the traffic sector. The situation in the EU will be similar but postponed by approximately 10–15 years.

cost, technical applicability and environmental improvements.

These criteria have to be completed by long-term security of supply and economic and public gain (gain for fuel and automotive industries, customers, economics and environment) (Fig. 5).

The pre-selected fuels as alternatives to gasoline and diesel will be natural gas and fuels derived from natural gas and renewable energies with a long-term regenerative potential, in particular compressed and liquid natural gas, compressed and liquid hydrogen, dimethyl-ether, methanol and synfuels.

## 2.1. Outlook

Balancing the environmental challenge with concern about employment and energy security will be the essence of energy policy.

The EU Commission's White Paper on Energy Policy published in 11 out of 97 states: "domestic energy sources on the basis of renewable energies will play an increasing part to reduce the dependence of energy imports and to improve the environmental impacts of energy use. Renewable energies will undertake an important part with positive effects on economics and security of energy supply."

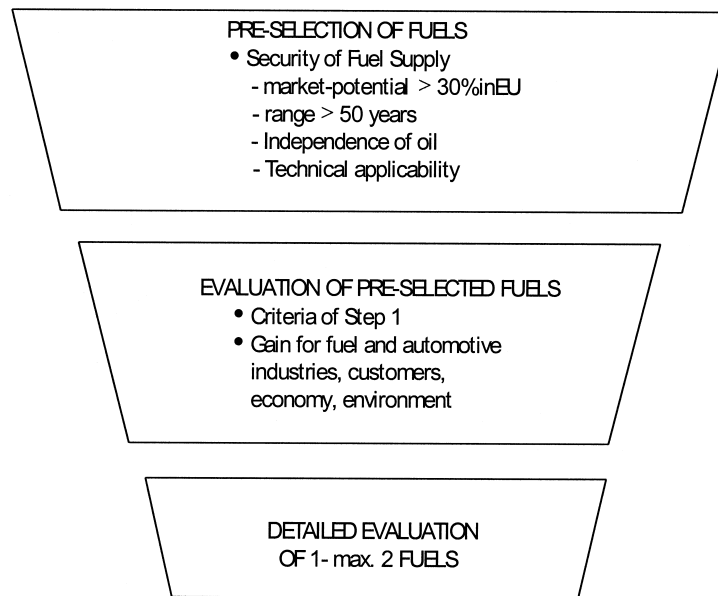


Fig. 5. Process of fuel evaluation at present under development in the framework of an industrial initiative in Germany to define one or, at most, two alternative fuels to be introduced into the market within next years.