Technological Forecasting & Social Change 76 (2009) 327–338

Contents lists available at ScienceDirect

Technological Forecasting & Social Change

Technology foresight for a vision of energy sector development in Poland till 2030. Delphi survey as an element of technology foresighting

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ARTICLE INFO

Article history:
Received 21 December 2007
Received in revised form 24 March 2008
Accepted 27 May 2008

Keywords:
Delphi survey
Technology foresight
Scenarios
Energy
Energy security

ABSTRACT

The security of energy supply at national level is one of the most fundamental missions of every government. This task becomes especially vital in view of the current situation on global energy markets. The planning of technological development in the energy and fuel sectors is a relevant element of energy security strategies. This in turn leads to a more rational and efficient energy use in the future. Technology foresight, which emerged as a proven instrument of technology policy during the 1950s, becomes nowadays one of the essential tools for the creation of the future technological development worldwide. A project entitled: "The Scenarios of Technological Development of Fuel and Energy Sector for National Energy Security" was the first foresight project in the field of energy technologies and at the same time the first technology foresight activity in Poland. This project was being carried out in the period of 2006–2007 by a consortium of research and development institutes on the request of the Polish Ministry of Economy. The aim of the project was to indicate energy and fuel sector development directions in the time horizon up to 2030 and identify key energy technologies of strategic importance. As a result of the foresight activity, technology development scenarios in the energy and fuel sector in Poland as well as corresponding roadmaps for their implementation were formulated. The project results should be helpful in drafting national energy policies and they will indicate priority pathways of research and development (R&D) activities in the next years. The energy foresight project was based mainly on a Delphi method that is nowadays widely applied as a valuable foresight tool. This future-oriented intuitive method was engaged for the qualitative and quantitative assessment of probable developments in the future and for their time scale evaluation as well. In this article, the results of the conducted two-round Delphi survey were presented.

1. Introduction

A growing number of energy-related foresight activities worldwide clearly reflects the importance of issues related to energy sector. Such projects have been performed at global [1], continental [2–4] and national level [5–8] either as strictly energy oriented foresight projects or as a part of broader foresight activities. The driving forces for the actions in particular countries and regions stemmed from the need for security of energy supply, especially in places where own fuel resources are poor or are rapidly diminishing. The common elements of these projects are usually as follows:

- energy demand issues,
- emerging energy technologies,
- new transportation solutions,

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0040-1625/$ – see front matter © 2008 Elsevier Inc. All rights reserved.
doi:10.1016/j.techfore.2008.05.007

Table 1
The structure of primary energy consumption (%) in 2003–2004 [9]

Energy carrier	World	EU	Poland
Hard coal and lignite	25.1	18.0	61.3
Natural gas	20.9	24.0	11.8
Crude oil	34.3	37.0	21.7
Nuclear	6.5	15.0	0.0
Renewable sources, including:	13.2	6.0	5.4
Hydropower	2.2	1.5	0.15
Biomass	10.6	4.0	5.2
Wind power	0.4	0.2	0.01
Geothermal		0.3	0.007
Solar		0.03	0.0
Total consumption (Mtoe/year)	11069	1726	94.1

- reduction of greenhouse gases emission,
- reduction of air pollution emissions,
- implementation of renewable energy sources,
- energy saving practices.

Some differences observed in a foresight approach result from high specificity of countries and regions covered by the foresight actions. In Poland, technology foresight study for energy sector has been undertaken for the first time.

2. Rationale and objectives of the foresight exercise in energy technologies in Poland

The energy sector in Poland is almost exclusively based on coal. The specific structure of primary energy carriers consumption stems from the level of national hard coal and lignite resources. The documented Polish balance reserves for the end of 2005 were 43,321 and 12,634 billion tons of hard coal and lignite respectively. These figures place Poland among the countries of the most abundant resources of these fossil fuels. Another important factor is the lack of considerable national resources of crude oil and natural gas. Current Polish production capacities of crude oil and natural gas satisfy national demand in 5% and 19% respectively. The consumption of primary energy carriers in Poland compared to World and EU in 2003–2004 is shown in Table 1.

A characteristic feature of Polish energy economy is a very high (about 95%) share of coal in electricity production. As a result, the energy sector is the biggest CO_2 emitter in the Polish national economy. The need for reduction in greenhouse gases emission is currently expected to be a fundamental issue governing the structure of many national energy systems in a perspective of the next few decades. The increasing dependence on external energy suppliers in connection with global policies in terms of greenhouse gases mitigation inspired Polish authorities to perform the foresight exercise.

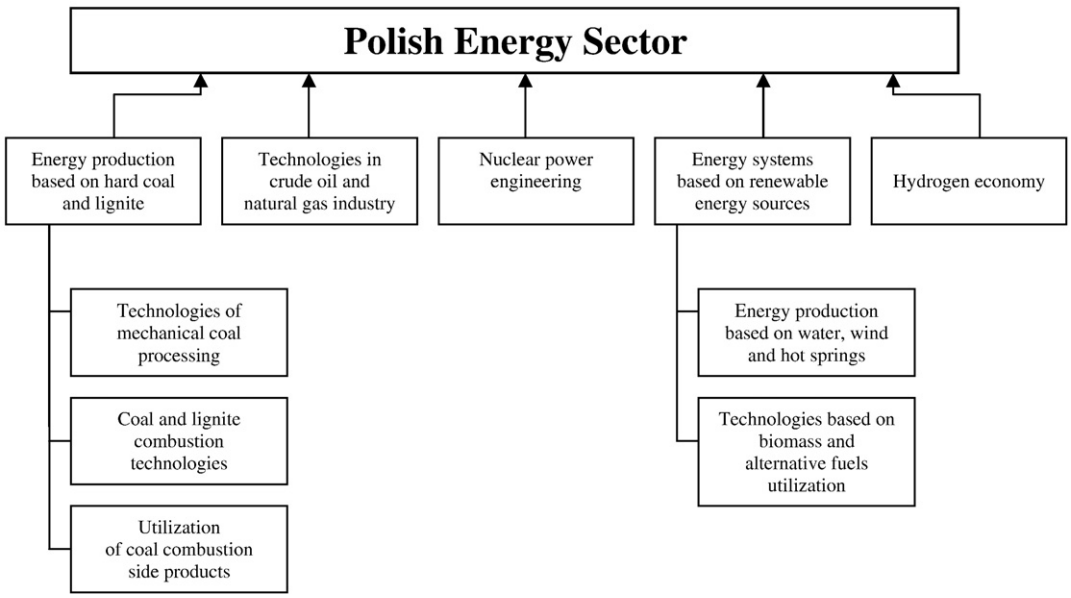

Fig. 1. Thematic boundaries of the energy foresight exercise.