Division Environment and Infrastructure
TERNA Wind Energy Programme

Energy-policy Framework Conditions for Electricity Markets and Renewable Energies

21 Country Analyses

Eschborn, June 2004

Part Yemen

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Background to the New Edition

Structural changes in the energy sector, accompanied by liberalisation of the relevant markets, have been continuing in many developing and transition countries in recent years. Growing demand for electricity and the ongoing climate debate are increasing the level of interest in technologies for generating electricity from renewable energy sources in these countries.

The rapid expansion of the use of renewable energy in Germany is a subject that is being followed with interest, even outside Europe. Experience here shows that the creation of a conducive political and economic framework and the implementation of appropriate promotion measures can speed up the exploitation of renewable energy.

The German and European market acts as the motor for a wind energy industry and provides an indispensable background of experience. The level of growth in this sector within Germany has slowed down, however. Project developers are therefore increasingly turning their attention to off-shore schemes, other parts of Europe, and the Mediterranean states. The markets for technologies based on other renewable energy sources are also experiencing growing interest. While it is true that the potential for hydropower, wind power, solar power, biomass and geothermal energy in developing and more advanced countries is often considered to be high, obstacles to entry into this field include insufficient knowledge of the framework conditions prevailing in the energy industry in those countries and a lack of transparency with regard to the prior experience and interests of the national actors.

One of the aims of this third, updated and expanded edition of the study – under a new title – is to facilitate entry into the field of renewable energy. It is based on the previous editions from 1999 and 2002, which were published under the title 'Producing Electricity from Renewable Energy Sources: Energy Sector Framework in 15 [or 12] Countries in Asia, Africa and Latin America'. These studies have been much in demand, not only by suppliers and project developers but also by financing and operating companies involved in renewable energy technologies.

The analyses of the individual countries comprise sections on the respective electricity markets and the actors in those markets, along with information on the energy-policy framework. The policy for promoting electricity generation from renewable energy sources is examined, and the status of the various forms of renewable energy is analysed in detail. The chapters on each country are rounded off by information about rural electrification.

In comparison with the 2002 edition, eleven new countries have been added. The information about a further ten countries has been updated:

New since 2002		Updated	
Albania	Philippines	Brazil	India
Bosnia - Herzegovina	Senegal	Chile	Mexico
Croatia	Sri Lanka	China	Morocco
Georgia	Vietnam	Colombia	South Africa
Jamaica	Yemen	Dominican Republic	Tunisia
Pakistan			

Information about Argentina, Cuba, Jordan, Kazakhstan and Turkey is given in the 2002 edition. Analyses of Egypt, Indonesia and Thailand were conducted in the 1999 edition. These previous editions are available in electronic form free of charge from www.gtz.de/wind/english/downloads.html.

Our grateful thanks go to a large number of GTZ staff members and other experts for their help with putting this information together.

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Legal Information

1. The data used in this study is based on both publicly accessible sources of information (publications, specialist articles, Internet sites, conference papers etc.) and non-public papers (for example internal expert reports from promoting institutions), as well as personal interviews with experts (for example officials at energy ministries in the investigated countries and project staff at promoting institutions). Although all information has been checked as far as possible, errors cannot be ruled out. Neither the GTZ nor the authors can therefore provide any guarantee of the accuracy of the data included in this study; no liability can be accepted for any loss or damage resulting from use of the data included in the study.

2. The sole authorised user of this study for all forms of use is the GTZ. Duplication or reproduction of all or part of the study (including transfer to data storage media) and distribution for non-commercial purposes is permitted, provided the GTZ and the TERNA Wind Energy Programme are named as the source. Other uses, including duplication, reproduction or distribution of all or part of the study for commercial purposes, require the prior written consent of the GTZ.

The TERNA Wind Energy Programme

Specialised knowledge and experience are needed to determine what wind energy resources a country possesses and to identify suitable locations. Technical and economic analyses of wind power projects are also impossible without hard information about wind conditions. Such analyses, however, form the basis for the financing and ultimately the successful implementation of a wind farm.

The purpose of the TERNA (Technical Expertise for Renewable Energy Application) Wind Energy Programme, implemented by the GTZ on behalf of the Federal German Ministry for Economic Cooperation and Development (BMZ), is to assist partners in developing and more advanced countries in planning and developing wind power projects. Since 1988 the aim within the TERNA framework has been to lay the foundations for sound investment decisions while at the same time enabling partners to plan and develop further wind power projects in the future.

The TERNA Wind Energy Programme's partners are institutions in developing and more advanced countries that are interested in commercial exploitation of wind power: these include, for example, ministries or government institutions which have the mandate to develop BOT/BOO projects, state-owned or private energy supply companies (utilities) and private enterprises (independent power producers).

TERNA offers its partners know-how and experience. In order to initiate wind power projects, favourable sites must be identified and their wind energy potential ascertained. To do this, wind measurements are normally taken over a period of at least twelve months and wind reports are drawn up. If promising wind speeds are found, the next step is to conduct project studies investigating the technical design and economic feasibility. TERNA also provides advice to partners on matters of finance, thus closing the gap between potential investors and offers of funding from national and international donors. If required, CDM baseline studies can be prepared and advice can be offered to potential operators on setting up an efficient operator structure. In order to ensure as much transfer of know-how as possible, efforts are made to ensure cooperation between international and local experts, for example when preparing the studies.

In successful cases, TERNA initiates investment-ready wind farm projects by this method. TERNA itself is not involved in financing. In addition to the activities that are tied to specific locations, TERNA advises its partners on how to establish suitable framework conditions for the promotion of renewable energy sources.

The prerequisite for promotion by the TERNA wind energy programme is that project development has a realistic prospect of implementation: if the underlying conditions in the electricity sector are sufficiently favourable, and if the proposed wind farm project has a minimum capacity of roughly 20 MW and is situated in a windy area (expected annual average wind speeds of over 6 m/s at a height of 10 m above ground level). Small individual installations or decentralised wind/diesel systems are not normally eligible for promotion, nor are research projects.

Up until 2004, TERNA has been active in over ten countries around the world. In Colombia the first wind farm started operation at the end of 2003 with the help of the TERNA programme. The municipal utility of Medellín built the 19.5MW Jepírachi wind farm on the Guajira peninsula with a total investment volume of some 27 million euros. The 800,000 tons of carbon dioxide saved by the wind farm by 2012 will be documented and sold to the Prototype Carbon Fund (PCF), which will mean additional revenues of around 3.2 million euros for the investor.

The TERNA projects are not financed from the country quotas which the Federal Germany Government agrees with individual partner countries. From the viewpoint of the partner country, therefore, TERNA offers additional funds for wind energy.

Further information on the GTZ's TERNA Wind Energy Programme, the application procedure etc. is available at www.gtz.de/wind or directly from:

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Electricity Market

Generating capacity

The state-owned utility company, the Public Electricity Corporation (PEC), operates 50 individual generating plants, three of which are steam turbines fuelled with oil. All of the other plants are diesel generators, around 40 of which are operated in isolated grids. The total capacity of the steam turbines (in Ras Kanatib near Al-Hodeidah, in Al-Mukha and in Hiswa near Aden) is 450 MW, that of the diesel generators supplying the interlinked power system something over 200 MW, and that of the off-grid diesel generators 235 MW. The contribution made by grid-coupled diesel generators to electricity generation is considerably lower, however. Numerous plants, even those with a relatively large capacity, are unavailable at times because of breakdowns and repairs, to the extent that availability overall is no higher than roughly 60%.

Apart from PEC, other bodies operating generating capacity include local authorities and in particular industrial and commercial self-generators. The total installed capacity of all generating sectors amounted to 1,234 MW in 1998.

The generating capacity provided at the moment is well below the level of demand, which means that power cuts are an everyday occurrence in many towns and cities. The Ministry of Electricity estimates the need for new power station capacity at about 1,650 MW by 2020.

Power generation

Gross power generation by PEC totalled more than 4,000 GWh in 2003 and has also grown substantially in recent years. Peak load is likely to be about 700 MW at present.

	2000	2001	2002	2003
Gross electricity generation (GWh)	3,387	3,654	3,813	4,090
Net electricity generation (GWh)	3,130	3,380	3,539	3,809
Electricity sold to end consumers (GWh)	2,079	2,244	2,477	2,736
Losses (technical and non-technical) in %	31.3	31.4	27.4	26.3
Average revenue (rials/kWh)	9.2	10.9	11.9	12.2
Cost-covering tariffs (rials/kWh)	13.9	16.7	17.8	18.1

Table 47: Electricity generation and sales, losses and electricity tariffs; Yemen; 2000–2003; GWh, %, Rials/kWh

Transmission grid

The transmission grid operated by PEC mainly supplies the western part of the country, while extensive areas in the eastern provinces are not within reach of the central supply system. A high-voltage transmission route, carrying 132 kV and about 2,000 km long, connects the regions around Sana'a with Aden in the south, passing longitudinally through the relatively densely populated uplands. However, only a total of 580 MW is fed into this line, and even this is only 60% available. Another main line connects the seaports of Hodeidah and Al-Mukah to Sana'a and Taizz, and runs parallel to the Red Sea coast. A further short high-voltage transmission route, separate from the others, runs near Al-Mukalla on the Gulf of Aden.

New 400kV transmission lines which would extend the grid to the east and north are currently at the planning stage. It is not foreseeable at present, however, whether these extensions will really come to fruition. An extension in the direction of Marib is the most likely as a gas-fired power station with a capacity of 300 to 400 MW is planned in this region.

Electricity consumption and losses

Electricity consumption grew at an average rate of more than 6% per year in the 1990s. In view of the low level of industrialisation in the country, consumption is largely concentrated on (urban) households and trade. Despite the high rates of growth in demand, per capita consumption is very low, at less than 150 kWh per year. The reason for this is the low income of the population and the large number of households which until now have

had to manage without regular power supplies. Accordingly, electricity consumption is very largely concentrated on the conurbation around Sana'a, Aden, Hodeihad and Taizz.

Although there has been a relative reduction of losses in recent years, the absolute quantities of electricity for which no payment was made have remained almost the same. High technical losses are compounded by financial shortfalls due to theft or refusal to pay. All in all, losses are presently still at a level of over 26%.

Tariff system

The tariff system for households has a progressive structure. In addition, standing charges have to be paid, which for households with a single-phase power supply, for example, come to 200 rials/month (approximately € 0.9). Consumers who obtain electricity at a high voltage level have to pay supplementary demand prices.

	Tariff (rials/kWh)
Households (urban)	
1–200 kWh	4
201–350 kWh	7
351–700 kWh	10
> 700 kWh	17
Households (rural)	
1–100 kWh	7
> 100 kWh	17
Industry	15
Craft & trades	18
State facilities	18

Table 48: PEC electricity tariffs by customer groups; Yemen, from August 2001; rials/kWh

Rural consumers pay a far higher price than urban customers. However, compared with most local authority units with self-contained supplies, which ask their customers to pay about 20 rials/kWh (9 eurocents), the PEC tariff is actually low. Because of the tariff structure, the relative attractiveness of low diesel prices and the negative impacts of daily power failures, in recent years a number of commercial and industrial consumers have chosen to go down the route of generating their own electricity.

On average the electricity tariffs for PEC customers in 2003 were around 12.2 rials/kWh, and therefore still well below the level that would be needed to cover costs, which is about 50% higher. The difference is currently made up directly from the national budget. One particular problem is the poor payment behaviour, which also applies to government agencies and facilities.

Market Actors

The Yemeni electricity sector is composed of four different segments:

- public sector, which is served by the state-owned Public Electricity Corporation (PEC)
- autonomous supply by local authority units, which in the past was supported by a state assistance programme (GAREW)
- self-financed electricity generation in industrial and commercial enterprises
- private households and independent power supply for government buildings with their own diesel generators

PEC

PEC is a vertically integrated public utility company that serves most of the larger cities and urban centres in Yemen. It arose from the amalgamation of two independent public electricity supply companies following the unification of North and South Yemen. In addition to the major generating plants, PEC also operates the interconnected grid and several isolated supply systems in rural regions.

Low electricity tariffs led in the past to the financial and technical collapse of the generating sector. PEC had to cope with substantial and rising operating losses after the two utility companies in the north and south of the country were merged in 1991. Insufficient financial resources made it more difficult to purchase spare parts and led to a lack of investment in the modernisation and expansion of plants. Most of the required capital expenditure was financed by the state. As a consequence the quality of supply declined to such an extent that power failures, load shedding and considerable fluctuations in voltage are everyday occurrences. The electrification of

rural regions has been only partly implemented, with more than half of power supplies being provided by co-operatives, the private sector and self-generation.

Legal Framework

The implementation of a comprehensive reform programme in the electricity sector has been in progress since 1997, but to date this has produced only few substantial changes. In recent years the government's efforts have primarily concentrated on improving efficiency by reducing the high levels of losses, and on strengthening the financial position of the PEC by adjusting the tariff structure and improving the collection of payments from customers. Several reform approaches have been examined during the past few years, with consideration being given among other things to privatisation of part of the state power supply facilities. Fundamentally some form of participation by the private sector in the field of power generation for public supply is possible and expressly desired, although until now it has not proved possible to bring any such scheme to fruition. Proposals for a new electricity law and a reform implementation programme were submitted to the cabinet for consultation, and are currently under discussion in ministerial committees.

Clean Development Mechanism

Yemen ratified the Framework Convention on Climate Change in February 1996, and in October 2001 it presented a national climate change report. So far the country has not acceded to the Kyoto Protocol, so for the time being no emissions trading under the CDM will be possible either.

Policy for Promoting Electricity Generation from Renewable Energy Sources

A department for renewable energy was established within the Ministry of Electricity and Water (MEW) in 1991. With the adoption of a cabinet resolution on the electricity strategy of 1999 (No. 199), MEW and PEC were called upon to pay greater attention to the development and use of renewable forms of energy. In this connection, in 2002 among other things a fund was set up for the initiation of rural electrification projects on the basis of renewable energy, under the auspices of the department for renewable energy. A first call for tenders was issued in 2003 for the supply of 80 PV systems to provide electricity for households and for pumping water, and for three small wind generators for the rural electrification of a village in Abyan Governorate. In addition, in 2003 MEW instructed the utility company PEC to invest at least 10% of its annual budget for rural electrification in technologies designed to exploit renewable energy sources. As a result, more than US$ 1 million per year is currently available for such applications.

A new Ministry of Electricity (MoE) was created in 2003. Both it and the Department for Renewable Energy emerged from the Ministry of Electricity and Water.

In recent times the Ministry of Tourism and, within the context of climate protection activities, the Environment Protection Authority, have become active in the dissemination of technologies utilising renewable energy.

Preparations are under way to set up a national renewable energy council with a membership made up of ministries, the supply sector, scientific institutions, the private sector and non-governmental organisations.

International projects

Under its Energy Sector Management Assistance Programme (ESMAP), the World Bank is currently conducting a study into the development of a rural energy strategy aimed at alleviating poverty. The study will also look closely at the feasibility of utilising renewable energy sources. The project has funding of US$ 200,000 and is due to be completed in 2005.

In 2001 the Economic and Social Committee for West Asia (ESCWA) published a study entitled 'Potentials and Prospects of Electricity Generation using Renewable Energy Sources'. The survey was devoted in particular to the economic conditions for greater use of photovoltaics in rural regions.

A request for financial assistance was submitted to the Japan Climate Change Initiative Grant to develop a wind and solar atlas, but also to build technical capabil-

ities at the department for renewable energy within MEW and to design a suitable legislative framework. The project was supposed to commence in mid-2003.

GTZ project

In a new advisory project that is to be implemented between 2004 and 2007, the GTZ is assisting the Ministry of Electricity (MoE) with the provision of improved energy services in rural areas. The project has been granted funding of some € 1 million, and is being implemented in the MoE in close collaboration with a CIM specialist adviser.

Status of Renewable Energy Sources

Despite various announcements and recommendations, it is still the case at present that no national plan for the exploitation of renewable energy resources on a broad basis has been completed. So far, the use of such technologies has been sporadic, and barely extends beyond individual pilot schemes and limited commercial areas of application. No specifically targeted dissemination activities or information campaigns by the government or state institutions have taken place to date. Obstacles to practical implementation and broader application, especially in rural regions, have been hardly investigated up to now, the private sector is only partially involved, and the market situation is not sustainable.

Hydropower

Yemen is a country with a marked lack of water resources. The running water in the mountains is mostly taken for irrigation or for drinking-water supplies, and because of the distribution of rainfall it is not available throughout the year, either. Under these circumstances, the use of water for energy extraction is possible to only a very limited extent.

Wind Energy

Experience with the exploitation of wind power is very limited, apart from the use of windmills for water desalination near Aden a number of decades ago and for pumping water near Al-Hudaidha in the more recent past. A small wind turbine installed on the university campus in Aden about 20 years ago ran for only about 1 or 2 years, presumably because the wrong location was chosen. More recently a relatively small experimental wind generating plant that was donated by Jordan was erected by PEC at the Al-Mukha power station.

GTZ investigation into potential sites

As part of a GTZ mission, several sites for wind farms were surveyed near Dhamar, Aden and Al-Mukha in August 2001. These locations were chosen first and foremost on the basis of favourable wind data, the possibility of connecting them to the central transmission grid and the nature of the topographical features. According to the Yemeni Civil Aviation and Meteorological Authority (CAMA) there are other suitable locations for the exploitation of wind energy with larger installations on the island of Socatra and near the city of Al-Mukalla.

A common feature of all of these sites is that the available sets of wind measurements, some of which are incomplete, are of only limited informative value as to the actual wind resources because the data was not recorded in accordance with usual practices. Pronounced seasonal fluctuations are always a conspicuous characteristic. In addition, particularly in the regions near the coast of the Red Sea and the Gulf of Aden periodic sand and dust storms occur which are likely to make special technical precautions a necessity. Not only that, in the immediate vicinity of the sea high air temperatures coupled with a high moisture and salt content make conditions for the exploitation of wind power more difficult. The transportation of plant parts on the roads, on the other hand, is only likely to pose certain logistical problems for locations in the uplands.

Nevertheless, fundamentally there appears to be a possibility for large-scale use of wind power following evaluation of the available data at least in the lowlands near the coast, whereas in the uplands the wind conditions are subject to considerable local variations, especially because of the topographical influences.

Biomass

Yemen possesses a biomass potential that has not been recorded in numerical terms, although there is no doubt that it could also be developed for power generation. However, the resources are likely to remain limited to residual products from agriculture and food processing,

as the utilisable agricultural area is finite and is already being used intensively for growing foods and luxury products, and consequently opens up little additional potential for energy use. What is more, the overall volume of timber is small. Previous experience with the use of biomass for energy generation is restricted to a number of small plants for producing biogas, most of which were set up in the 1980s as part of a scheme promoted by the United Nations.

Solar Energy

Average daily solar irradiation is around 4,500 to 5,500 kcal/m^2. The average daily length of sunshine ranges between 7.3 and 9.1 hours.

Experience with solar applications for electricity generation is very limited in Yemen. The main users are to be found in the telecommunications sector for telephone systems and for TV and radio transmitters. The first photovoltaic installations were put in place in the early 1980s by Yemen Telecom. A few individual irrigation projects with solar-operated pumps were supported by international assistance funds, including a small water pump rated at 600 W_p that was financed by the GTZ as part of an agricultural project. Health centres and a few educational establishments have also been equipped with PV modules for basic electrification (total capacity approximately 20 kW_p). It is reported of most of these early projects, however, that they broke down after only a short time in service because of poor management and a lack of spare parts.

ESMAP project from 1990 onwards

Rural electrification with solar systems began in 1990 within the framework of an ESMAP-financed project by the World Bank. This project envisaged the involvement of the private sector and the preparation of business plans and marketing plans. On account of financial and administrative problems, however, it was not possible to implement the project as planned. Activities were therefore ultimately limited to training courses and the installation of 14 solar home systems, although most of these ceased operation after a few years.

Despite these setbacks, solar home systems (SHSs) on the basis of private initiatives have proved successful in some areas. Recently a domestic market has developed with dealers selling complete PV systems to financially well-to-do customers in rural parts of the country. All in all, however, the installed capacity of SHSs is not likely to be more than 100 kW_p.

Bilateral projects

Other PV schemes intended to promote rural electrification for private households and social facilities have been supported by individual donor countries. The Netherlands, for example, supported the installation of four school systems and a hybrid PV/wind installation for a cultural centre in Hadramaut with a subsidy. However, these schemes too were not sustainable, because of a lack of knowledge of how to operate and maintain the systems and because of incorrect use.

Geothermal Energy

The topography of Yemen is of volcanic origin. Natural hot-water springs emerge at more than seven locations. The geothermal heat profiles appear to be sufficient to power installations for electricity generation.

In 1984 the exploitability of geothermal sources in the region of Dhamar was investigated by Geothermex Inc. with financing by the World Bank. The potential for power generation from geothermal energy at that location was put at 125 to 250 MW.

Rural Electrification

According to statistics from 1998, almost 89% of urban households but only 13% of rural properties, in which roughly three quarters of the Yemeni population live, are connected to the public electricity grid. Altogether the coverage of public supply is no more than about 25%, but even those members of the rural population who do have a connection to the grid have to live with widespread deficiencies, such as unscheduled power cuts and limited supplies, normally for only a few hours per day.

Source of lighting		Households (%)
Electricity	Public grid	13.2
	Local communal grid	4.2
	Private local grid	6.0
	Own generator	2.6
Kerosene		59.6
Gas lamp		14.2
Other		0.2

Table 49: Sources of lighting for rural households; Yemen; %[289]

Degree of electrification

Including those with their own supplies, the degree of electrification in rural areas is approximately 26%. Some 10 million people have no access to any form of regular electricity supply. In 1998 more than 55% of the total population did not even have electricity available for such an elementary energy requirement as lighting. In rural areas this figure was even as high as 70%. Most of these households rely on kerosene or gas lamps for lighting, and use batteries for elementary electrical needs (such as radios or torches). A sizeable percentage of the rural population also uses rechargeable car batteries for stationary lighting purposes.

Isolated supply and autonomous generation

Apart from those rural households that are connected to the national power grid and at least have basic electricity supplies for a number of hours in the evening, grid access is focused on a small number of decentralised generating plants that are in the ownership of local authorities, PEC or private individuals and companies. These operators, working on a small scale, usually only maintain supplies during the hours of the evening. A very small number of households with high incomes operate their own generators, which as a rule are also only started up when needed, for example for lighting their houses or watching television.

Private supply in the 1980s

From the early 1980s onwards, private companies became successfully involved in the field of electricity production and distribution in rural regions of North Yemen. Most of these companies were relatively small and supplied only a small number of adjoining households.

GAREW 1994–2001

In 1994 a separate department for rural electricity generation and distribution was set up under the responsibility of the Ministry of Electricity (GAREW – General Authority for Rural Electricity and Water)[290]. GAREW was active until the beginning of 2001. It invited tenders for generators, imported them and installed them in various parts of the country, on a donation basis; altogether it installed 119 diesel generators with ratings between 50 and 1,000 kW and with a total capacity of roughly 55 MW. In addition, mini-grids were set up to distribute electricity. Subsequently, the local authorities and municipal cooperatives merely had to secure the operation and maintenance of the plants. In total about 156,000 households benefited from this scheme.

A range of projects were implemented with considerable delays and/or with substantial cost overruns. The programme was finally discontinued in 2001, because the municipalities did not have the funds for spare parts or repairs and the availability of most plants is very low.[291] Given both high diesel prices and inefficient motors, the cost of the electricity is normally far in excess of that from the state-owned power utility. The survival of many of these isolated grids and generating plants is anything but certain.

PEC – Rural Electrification Department

Despite only recently having been given responsibility for rural electrification and for establishing a separate department in charge of that (Rural Electrification Department – REPD), the strategy of PEC is primarily geared to grid expansion and the security of (urban) supply.[292] Because of the limited available capacity of the existing power stations, this task is difficult to carry out.

Rural electrification with renewable energy

Given the existence of natural renewable energy resources such as sun and wind, there is a possibility of providing sustainable energy supplies and achieving at least a partial reduction in dependence on fossil fuels. One obstacle that still applies at present is the relative lack of experience with such technologies and the absence of adequate structures for financing, trading, operation and maintenance.

289 Source: Household Budget Survey 1998.

290 A similar initiative to GAREW also existed in South Yemen during the nineteen-eighties.

291 To some extent the problem can be attributed to the extremely drastic devaluation of the national currency, which has made all imported goods considerably more expensive.

292 In some cases rural supplies are also taken care of by the Department of Secondary Towns Electricity, which has the task of providing connections for the areas in the vicinity of small towns.

A preliminary study into the use of solar energy for rural electrification in the Governorates of Taiz, Hodeidah, Lajh and Abyan was carried out in 1998 and was financed by the French Government. A rural electrification strategy, likewise with PV applications as a key component, is currently being drawn up at the World Bank.

With regard to the small-scale utilisation of distributed wind power plants (as battery chargers or in hybrid diesel/wind systems), the lack of organisational structures is likely to be further compounded by the absence of technical experience, so the establishment of intensive training measures for the installation and operating personnel is essential for this to come about.

Call for tenders within the framework of the fund for rural electrification

Within the framework of the fund for rural electrification, a new start is being attempted at present to bring renewable forms of energy into use. The first call for tenders issued in 2003 is combined with an obligation on the part of the users to pay an initial charge of 5,000 Rials (about € 22) for the offered service and then an amount of 500 rials every month. This revenue is intended to be used for monitoring, maintenance and system expansion.

Exchange rate (9 March 2004): € 1 = 225 Rials; 100 Rials = € 0.44

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The potential of renewable sources of energy in developing and emerging countries is often considered high. Obstacles to their exploitation and foreign investors' engagement often include a lack of knowledge of framework conditions in the energy industry and insufficient transparency with regard to the prior experience and interests of the national actors. These are barriers which this third, updated and expanded new edition intends to overcome.

The **electricity markets** and their respective **actors** are investigated for **21 countries** in various regions: **Latin America – Caribbean, Africa, Europe – Caucasus** and **Asia – Pacific.** The country reports analyse the **energy-policy framework conditions** and closely examine the **status** of and **promotion policy** for electricity generation on the basis of **hydropower, wind power, solar power, biomass** and **geothermal energy**. The chapters on each country are rounded off by information about **rural electrification**.

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