In the name of Allah the Merciful The Mercy Giving

Summary of the results of the third panel discussion on

The electric power crisis and its economic repercussions

Aden, May 20, 2021

The first axis: the features of the electric power crisis and its economic repercussions

The features of the electric power crisis can be summarized in a number of reasons as follows:

-1 general reasons:

Lack of political stability, wars, unrest, and a complete absence of good governance.

Failure to implement a comprehensive and clear strategy for developing the electric power sector in the long term, despite the existence of this strategy and its approval by the CabinetCramming the electric energy file into political wrangling.

Corruption prevails in all institutions that control the electric power file due to political interference in the countryManage it.

Lack of societal awareness in preserving ownership in the electricity sector and lack of commitment to pay their obligations.

-2 Technical reasons:

- The institution’s failure to obtain the economic cost of its activity from its revenues and government support was a reason for impeding the implementation of any maintenance or technical development plans.

- The government's resort to immediate patchwork solutions to buy energy from others, which will affect government power stations and neglected to fix it.

The adoption of diesel as the main fuel, whether for government or purchased stations, which raised costs, and depleted the state’s finances, noting that the cost of the fuel component constitutes about 80% of production costs.

Weak technology for the energy sector infrastructure in general and in particular:

A - Obsolete - transmission and distribution networks.

B - a deficit - in the capacity of electric generation, as the available electrical generation does not cover the energy demand, for example, the electrical generation capacity of the Aden Governorate stations is 200 megawatts, while the average projection reaches 600 megawatts in the summer of 2021.

T - high - the value of the loss that reaches 50% of the produced electrical generating energy.

Fuel price fluctuations and insufficient quantities for safe operation.

Low sales tariff per kilowatt. Courier compared to costs, economic and the lack of government support to bridge the entire financial gap between costs and revenues.

- - The transportation network has been sabotaged by the ongoing conflict since 2011 in many regions.

- The most important technical reasons for the electricity crisis in Aden are the obsolescence of the components of the power generation stations and their failure to replace them according to the approved studies, and the separation of the Aden network from the national network deprived it of about fifty megawatts that were imported from the national network.

Failure to perform maintenance in power stations in a timely manner.

Failure to provide financial allocations for the supply of spare parts to carry out periodic maintenance.

Neglecting studies submitted by international consulting firms to reform the electric power sector, especially in the technical aspects.

Paralysis of the national grid in meeting the electricity needs of the population in most cities and rural areas, and the majority of the population relying on themselves to generate electricity.

C. causes - administrative and planning:

- The absence of a comprehensive, clear, long-term strategic plan to develop the electric power sector to meet the needs of economic growth and the increase in demand resulting from urban expansion and population increase.

- Poor management of the electric power crisis file and the absence of a comprehensive vision to deal with the current problems and being satisfied with temporary treatments.

Failure to implement laws, regulations and regulations in this sector and the prevalence of random work.

- The absence of a comprehensive plan for training and qualification for employment, lack of benefit from experience, and the rule of favoritism when hiring and promoting misuse of resources and the prevalence of corruption in the electric power sector due to political interference.

B - the economic repercussions of the energy crisis

1- Economic Implications for Production:

- - The production sector in Yemen has been affected, especially the industry and services sector, as the industrial sector occupies 12% of the employment, and the services sector includes 46.9%, as their contribution to the GDP for the year 2019 decreased by 55.3% and 43.1%, respectively, compared to 2015. Part of this decline is due to the electric power crisis, which led to:

A- The high percentage of production costs and expenditures.

B - the high cost of storage and spoilage of part of the production.

C- Rising transportation costs.

W - lay off part of the labor to reduce operating expenses.

-The effect of power outages disrupting work for large parts of public and private facilities, which delayed transactions and worker productivity.

- The facilities and offices, especially the banking sector, incur additional expenses as a result of purchasing generators

- Electricity and fuel for it.

In the agricultural sector, the increase in the price of fuel or its lack of fuel has increased irrigation costs and water prices, forcing many farmers to abandon their farms and people have lost their source of livelihood on a large scale, as employment in agriculture constitutes about 80% of the Yemeni economy.

- Exposing retail channels to losses of spoilage of goods, especially those in need of refrigeration, or incurring additional expenses for the purchase of fuel and generators, causing goods to be offered at higher prices to the citizen.

- The consumer was affected by direct and indirect ways to buy products that were exposed to higher than normal temperatures as a result of not preserving them in a cold atmosphere, and thus affected the health of the consumer.

B - to the population services

- - Critical infrastructure facilities, including hospitals, water wells, sewage treatment plants, banking systems providing services to residents and telephone networks, have been severely affected, and many people have lost their livelihoods.

- The United Nations Office for the Coordination of Humanitarian Affairs estimates that nearly 20 million people, or about two-thirds of the population, are in urgent need of food, water and basic health care, which are sectors that depend heavily on electricity.

- The impact on the academic levels of school and university students through power cuts for long periods, especially in the summer.

C - on economic development

- The dependence of economic activities on energy as one of the pillars of the production process based on it the backbone of life and the engine of the economic development and economic growth process in the country.

- The decline in economic indicators and economic growth in all economic sectors heralds an economic catastrophe and its exacerbation year after year.

- The fuel shortage and high prices caused a decrease in the generation of electricity using fuel by 77% between 2014 and 2015 and beyond, which indicates a decrease in the emissions of night lights from Yemen by two thirds, which indicates the decline in economic activity in most cities and the decline in economic growth.

Unemployment and poverty increased and the number of people dependent on food aid due to the decline in economic growth.

The second axis: a future vision with solutions and proposals to solve the electricity problem in the country

Below we present a package of proposals and solutions to the crisis of the electric power sector, as follows:

A - An overview of solutions:

1. Stopping the war, solving the political problem, and peace prevailing.

2. Initiate the development of a comprehensive strategic plan to solve the country's electricity problems, by making use of the experiences of successful countries and seeking assistance from international companies.

3. Reunification of state agencies supervising the electricity sector.

4. Reconsidering the laws in force in the field of investment to prepare the field for the local, expatriate and foreign private sector to invest in electricity.

5. Neutralizing the electricity sector from political and partisan disputes.

6. Reshaping citizens 'awareness and culture in dealing with their obligations towards consumption of the electricity commodity.

7. Structuring and governing all state institutions, particularly the electricity and energy sector, on modern foundations.

8. Implementing Electricity Law No. (1) of 2009.

9. Reforming the general institutional, administrative, financial and informational conditions based on the "foundational and organizational study of the electricity sector carried out by Arthur Andersen in 2002" and its updates.

B - a vision in the institutional field:

1. Carrying out a comprehensive structural change in the Ministry of Electricity and Energy and the General Electricity Corporation based on indicators of efficiency in performance, speed in achievement, cost reduction, quality improvement in production, distribution and consumer service.

2. Reconsidering the laws, regulations, systems, and organizational structures currently in effect, which formed a incubator vessel for corruption.

3. Reactivate the will and unity of decision and place the right man in the right place in terms of appointment, promotion and employment in the electricity and energy sector from top to bottom.

4. Solve the problem of employment in the electricity and energy sector a radical solution and develop a modern and comprehensive job description for all jobs. Employment should be done accordingly. Employment and appointment are competitive.

5. Providing the necessary financial allocations for the modernization of the electricity and energy sector in the field of modernization and digitization of administrative work and the transition to electronic management in the field of management, information and providing services to consumers.

6. Restructuring the management of the Electricity Corporation by establishing three new companies in the fields of production, distribution and collection that are independent of each other and redistribute the labor according to that.

7. Reconsider the extreme centralization in the management and planning of the electricity sector, and the involvement of localities, civil society organizations and consumers in solving, developing and maintaining electricity problems as they are public domain.

8. Reconsidering the management of the electricity and energy sector in the financial aspects, especially revenues and expenditures, working in an economical manner, preserving funds and assets, maintaining

and modernizing machines and equipment, and permanent investment to maintain the readiness of electricity production equipment.

9. Support in the electricity sector should be provided to support the payment of electricity bills for people with limited income. A bank can be set up for this purpose, financed by donors, civil society organizations, and businessmen to solve the problems of arrears from the bills.

10. Reforming the tariff system currently in place to ensure transparency standards and covering costs to preserve the financial strength of the energy and electricity sector, due to the importance of this in improving the type of service.

C - A vision in the field of electric energy production and distribution:

1. Solving the technical problems of the electricity sector on the basis of fragmentation. The solution to the problems of production, distribution and collection by establishing three new companies based on the ruins of the General Electricity Corporation, but under a comprehensive, unified, interdependent and coordinated plan.

2. The energy and electricity authorities, when developing strategies, plans, and policies for reforming and developing electricity, benefit from the experiences of international companies and the results of studies of foreign consulting firms in previous periods, with the need to update them.

3. The strategy for solving the electric power problem should be based on the establishment of modern central stations with high capacities and that can be increased in proportion to the growth in energy demand and avoiding the establishment of low-power plants that are geographically far apart.

4. Using locally available fuels in the production of electric power, especially LNG, to reduce the production cost and the selling price at an appropriate tariff and commensurate with the rest of the world.

5. We recommend that the establishment of strategic central stations in the future be based on the BOOT investment system or (1) BOO and with PPA contract documents (2) according to internationally approved models, and to provide adequate guarantees to involve the private sector in solving the problem of electric power production.

6. The necessity to provide the necessary funds for the maintenance of the current electricity stations to provide the population with their essential lighting needs. (1) The term (BOT) is an abbreviation for the three words: Transfer –Operate -: Build, meaning (Build, Operate, Replay) or - - (Build - Own - Operate). It may appear in another form: - - BOOT, which is an abbreviation of: Build - Own - Operate - Transfer, meaning (construction, ownership, operation, return) - - -. (2) Contract documents (PPA) is an abbreviation for (Power Purchase) or a power purchase agreement. Two parties between two parties, one of which generates electricity and is (the seller), and the other party is looking to buy electricity, which is (Purchaser).

7. A comprehensive solution to the problems of the current stations that use liquid fuel, especially for those stations that can be operated on an economic basis, and to stop wasting the resources used in operating the dilapidated plants.

8. Shifting towards a diversification of energy sources through the establishment of energy production stations that depend on several alternatives to fuels and renewable energy, such as solar energy (thermal or photovoltaic), gas, wind, water currents, air currents, hot steam and waste.

9. Establishing comprehensive projects to modernize the old electricity company in stages to accommodate all potential new investments in the field of establishing large strategic stations and to meet the expansion of the future demand for electric power by taking advantage of the results of the study of the German Fitchener company and its updates.

10. Work urgently to reduce the loss of electrical current to reach the average international rates, or about 10% of the produced energy.

11. Using smart meters and a pre-payment system for collection and imposing reasonable fees to enter the service for new subscribers to reduce random connectivity and reduce the percentage of waste.

12. Urgent implementation of the repair and maintenance of electrical generating stations, especially the Haswa and Mansoura stations, as an emergency solution to reduce the daily stoppage hours in the governorate of Aden.

13. Solving the problems of old electrical generation stations in isolation from the new projects as a guarantee for the success of the new projects from the economic, technical and administrative aspects, in accordance with the approved international standards.

14. Reorganizing the current purchased electric energy operating with costly diesel fuel by replacing it with contracting for production units with high power, generating capacity and efficiency, using cheaper fuel, and transferring it if necessary to production companies under the investment system BOO or BOOT according to the approved laws.

15. Encouraging investment in the electricity sector in cities and rural areas by the people, providing the necessary assistance by the state and encouraging people to rely on themselves, especially in the production of electricity from solar energy.

16. Encouraging local initiatives to invest in the production of electric energy in governorates, districts, cities, and villages, and providing advice and assistance to them in order to develop innovative solutions to electricity problems in different governorates' conditions.

17. The use of the hybrid system (the integrated system) in this sector, which encourages the production of household and investment electricity and the sale of the surplus to the electricity establishment, especially in the field of electricity production from solar energy.

18. Study the possibility of importing energy from neighboring countries as necessary solutions to reduce the electric power crisis and achieve stability and energy security.

D - His vision of the role of the private sector in the solution:

1. The necessity of involving the private sector in solving electricity problems on the basis of Electricity Law No. (1) of 2009 regulating the partnership between the state and the private sector, especially in the fields of electrical generation and distribution.

2. Involving residents in solving the electric energy problem by lighting their homes by using solar energy, legally regulating that activity, and purchasing surplus electricity from residents using the (dual) integrated system.

3. Local councils in various administrative units can regulate electricity generation activities in cities and villages and self-reliance by establishing joint-stock companies for production and selling the surplus to the public network.

4. Supporting and encouraging the initiatives of the people and the private sector in increasing the production capacity of electric energy, which emerged due to the problems of the deficit in electric generation, as about 300 power generation stations were established throughout the country. The population also depends on self-produced electricity from solar energy by 57% in cities. And almost 50% of the population.

5. Yemen's investment in the production of electricity from solar energy during the past five years amounted to about one billion dollars, which is an indication of the necessity of increasing investment in this field in the future as an urgent and effective solution to the problem of electricity.

6. The necessity of abolishing any measures that limit the import of solar panels and energy production equipment, electricity from solar energy, and the abolition of any customs duties or taxes on the inputs of solar energy production to enable residents to secure their electricity needs.

7. The state should encourage the local, expatriate and foreign private sector to invest in the electric energy industry and create the appropriate environment for that, especially in establishing factories that produce the inputs of the electric energy industry from solar energy, such as establishing factories for the production of solar panels, liquid batteries, conductors, and others.

8. Enabling local and foreign investment to work in the activities of electrical generation, distribution and supply without delay, through building facilities, lease contracts, operating, managing and financing facilities, participating in the ownership of the facility and sharing shares in ownership with the state, and that these activities depend on the basis of building and owning and Operating projects and then transferring ownership to the state.

The third axis

Possible alternatives to renewable and clean electrical energy and the role of private investment in solving a crisis

Electricity in Yemen:

First: The alternatives and options available for generating electricity in Yemen

1. There are several options for generating electricity, whether through non-renewable energy, diesel, diesel, natural gas, or coal, or through renewable energy, such as wind, solar energy, dams, tidal energy, wind or energy emitted from the ground and others.

2. The type of energy and fuel used depends on several factors, the most important of which are:

- The cost of each type of fuel used.

- Cost - Establishment of stations.

- Extent - fuel availability, portability and cost.

3. Yemen has options available to produce electric energy and invest in several available and appropriate options, such as gas, wind energy, tidal energy, solar energy, wind and energy from the ground and from waste.

4. Generating electricity using gas fuel is the best option currently available, especially through the exploitation of the burning gas associated with oil in the oil fields in Shabwa and WadiHadramout, in addition to the presence of gas wealth in Marib.

5. Wind power plants are considered the second option for Yemen in generating electricity, as one of the international studies estimated the ability of Yemen to produce 34 thousand megawatts of electricity from winds in the area extending over the coast of the Red Sea, Bab al-Mandab and the heights in various governorates.

6. The power stations are considered from the sea, especially in the presence of the Mokha Bridge project - Mayon Island, which is expected to generate approximately 2,600 megawatts of electricity as a result of operating the turbines that generate electricity from the movement of sea waves upon its implementation.

7. The electrical energy generated from the heat of the Earth's interior is also considered one of the options available due to the presence of many areas in Yemen whose geological potential can be exploited to generate such stations, such as the Dhalea 'and Dhamar regions.

8. Electricity generated from solar energy is a promising and widely available option as well. This is due to the presence of clear sunny weather for long periods of the day in several regions of Yemen, especially the coastal areas, and it is an option that is increasingly used in the household sectors as a result of electricity outages in Yemen.

9. Electric power generated from coal is one of the recommended options within the study of solutions to the electricity problem in Yemen prepared by the American McKinsey Company, but the environmental impact is one of the limitations and caveats on such stations.

10. Generating electricity from waste is an option and a practical option, given that small and medium-sized power stations can be built between 10 - 225 megabytes, which contribute to generating electricity for cities and at the same time get rid of waste. In electrical generation (waste).

11. The table below shows the available capacities of renewable energy according to the study of the renewable energy and energy efficiency strategy prepared by the German Consulting Company for the Emir in 2008.

Table (1) Technical possibilities for connecting renewable energy to the public network

the supplier	Possibilities the theory (Megawatts)	Possibilities Technical	
		Macro (Megawatts)	Applied (Megawatts)
Wind	**308.722**	**123.429**	**34.286**
energy Thermal From Soles Earth	**304,000**	**29,000**	**2,900**
Electricity From energy Concentrated solar CSP	**2,446,000**	**1,426,000**	**18.600**
energy Vitality • **Gas Waste**	**20**	**12**	**6**
energy Hydraulics • **Dams the list** • **Valleys Main**	**1** **31-12**	**-** **1130**	**-** **-**
energy Solar Thermal • **System Heaters Water Solar H ousehold SWH**	**Mega watt thermal 3.014**	**Mega watt thermal 378**	**Mega watt thermal 278**

Second: Encouraging the role of the private sector in solving the electricity crisis by activating the Electricity Law No. (1) for the year 2009 and the Partnership Law between the private and public sector for the year 2014

The role of the private sector in solving the electricity crisis in Yemen is considered pivotal and important for several reasons:

1. The state's inability to provide the capabilities and financial resources needed to build various power stations.

2. The large financial and financing capabilities of the private sector, whether local or foreign.

3. Administrative and financial corruption in the electricity sector, which is one of the reasons for the aggravation of the electricity crisis and a major brake on its development.

4. The private sector's search for profit will push it to search for the best, cheapest and most sustainable mechanisms for generating electricity, while improving networks and reducing losses, which contributes to enhancing its profits, which will lead to stability and regularity of electricity and thus provide an appropriate service to the citizen.

5. Competition between the sector and private projects in the field of electricity will work to reduce tariffs and improve services.

6. The form of private investment in the sector can be mainly in the areas of production and distribution.

7. The private sector may be the owner or shareholder of ownership and management in the sector projects according to the internationally known participation and participation systems.

8. The contribution of the private sector enhances the possibilities of using renewable energy as it is the least fuel-consuming station, and thus the costs of electric generation are reduced, which means lower fuel import bill and lower harmful emissions.

9. There is a possibility for the private sector to invest in the energy and electricity sector, as there are currently more than 300 companies investing in the field of electricity and energy in Yemen, which indicates the great and continuous desire of the private sector to invest in this field.

10. The spread of the use of renewable energy in homes, agricultural and service fields, especially solar energy, in which the value of investments in the past five years amounted to more than one billion dollars.

11. The importance of the role of commercial banks in providing loans in the energy field, especially in the agricultural sectors. The best example of this is the role of the National Bank of Yemen in supporting farmers with loans in WadiHadramout to use renewable energy. The rest of the banks should also be urged to offer such financing programs to small investors and farmers. .

12. Encouraging the private sector to invest in industrial fields related to electricity as a subsequent stage to create vertical integration between all productive sectors related to electricity.

Third: The role of international organizations and donor countries in solving the electricity crisis in Yemen:

Donor countries and international organizations can contribute to solving the electricity crisis in Yemen through the following:

1. Reactivating the financing agreements signed with Yemen, whether in the field of electrical generation or transmission networks, such as the Mokha power plant project with a 60-megawatt wind power funded by the State of Kuwait and the World Bank, and the Damt electricity project from underground energy with a capacity of 8 megawatts funded by the World Bank.

2. Asking the donor countries to finance the updating of feasibility studies for the electricity sector in Yemen.

3. Urging international donor organizations to allocate an important part of the grants provided to Yemen to support the most needy groups of society in generating electricity from renewable energy to meet their electricity needs.

4. Urging the donor countries to focus on providing grants, assistance and expertise to Yemen in the field of renewable energy to contribute to limiting the import of fuel and at the same time alleviating the electricity crisis, as well as providing assistance to train staff in the electricity sector in various fields of electric energy activities.

5. The Economists Association urges the state to pay attention to well-trained and long-experienced competencies and to give them important roles when developing comprehensive strategies to solve the electricity problem.

A Bond of Economists

Supervision team and formulation of results:

1- Prof. Dr. Mohammaed Omar Banaja, Professor of Monetary Economics, Dean of the Faculty of Economics and Political Science at the University Aden.
2- Dr. Hussein Al-Malasi, Associate Professor of Foreign Investment, Head of the Department of International Economics, University of Aden.
3- Dr . Libya AbboudBahwerth, Associate Professor in Economics and Resource Management, and Deputy Dean for Affairs, Academic and Postgraduate Studies, Faculty of Administrative Sciences, Hadramout University.
4- Dr. Hatem Basarda. Head of the Business Economics Department. Faculty of Economics and Political Science.
5- Mr. Saleh Al-Jafri. Economist, and former Director General of Resources at the Ministry of Local Government.
6- Dr. Sami Muhammad QasimNuman. Assistant Professor, Department of Political Science, Faculty of Economics and Political Science.
7- Dr. Buthaina Abdullah Ismail Al-Arashah, specialist in international relations, and assistant professor in the Department of International Economics, Faculty of Economics and Political Science, University of Aden.

He did the review:

Eng. Salem Ahmed Bahakim, consultant electrical power engineering, advisor to the Ministry of Electricity and the Governorate Hadramout previously.