**"Urgent recovery pathways"**

1. **Preface:**

All the governors of the Republic of Yemen suffer from frequent outages of electricity and because electricity has become a necessity of life, Yemen's economy has suffered greatly owing to the absence of a strong infrastructure for the electricity sector. Rather, prospective solutions have become at the helm of successive Governments without looking at a medium- or long-term strategic plan, these promotional solutions, which at the time were planned to be emergency and temporary in today's reality, have become essential due to the absence of any operational procedures for the strategic pathway. Thus, for example, in the provisional capital, Aden, we have separate power plants on more than 16 sites. In addition, because most of these plants are not governmental or small-scale units with high consumption, the reason for their distribution in these sites is the lack of power transmission lines, limited and decaying transformative plants, as well as poor networking between the various directorates and regions in Aden.

The greatest concern that occupies all scientific research Centers in the developed world is often to ensure that we focus on two basic criteria to ensure access to energy at the lowest possible cost and using sustainable sources of operation, taking into account the preservation of the environment. Unfortunately, in Yemen we have been working for years at random, where the cost of production of energy as well as sustainable operational sources is not taken into account.

Thus, it was obvious to focus by Yemen's electricity professionals today. As regards the production, transport, distribution and sale of energy on its economic feasibility and to achieve sufficiency and utilization of available resources with high effectiveness and efficiency, it was necessary to study the economic cost of all political sectors of the electricity system. During this report, we will work on a preliminary comparative study of the cost of generating, transporting, distributing and selling electricity. This report will also be submitted to all government agencies and donors, and it will be necessary to take a decision urgently or to mandate a special committee to examine the details and make the necessary decisions in order to ensure and in the near future (18 – 24) months to preserve the State's wasteful resources, which have significantly affected the economy of the country and have been a major obstacle to the disruption of development and construction programmes. All the focus has been in the ambulance of governors and regions with high-cost emergency power stations and high consumption of heavy fuel.

1. **Statistics and results:**

**Summary of power generation in SPE service areas:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Region | Total Capacity | Total Capacity | Government Stations | Purchased Power Plants | Available Capacity |
| Abyan province | 76.65 | 40.1 | 22.1 | 18 | 70 |
| Aden province | 115 | 265.2 | 150.2 | 618.8 | 560 |
| Al-Mahra province | 64.2 | 46.15 | 46.15 | 0 | 60 |
| Hadramawt province (the coast) | 287.5 | 206 | 101 | 105 | 350 |
| Hadramawt province (valley) | 210 | 131.5 | 81.5 | 50 |
| Lahj province | 65 | 48 | 16 | 32 | 70 |
| Marib province | 432.2 | 397 | 345 | 52 | 85 |
| Shabwa province | 53.96 | 42.7 | 14.7 | 28 | 70 |
| Socotra province | 4.5 | 4.5 | 4.5 | 0 | 10 |
| Taiz province (Mokha) | 160 | 0 | 0 | 0 | 20 |
| total | **1,973** | **1,181** | **781** | **400** | **1,295** |

* **observation:**

The government stations, according to the table above are mostly produced from stations that have mostly exceeded the operating life, in addition to the fact that during the previous decade the periodic age maintenance was not adhered to at the time.

**Through this report, we have developed our urgent plan by charting urgent pathways that are the building blocks for the development of the electricity sector and the reduction of waste in the State's resources. The objectives of these pathways are mainly as follows:**

* Reduce waste in public money by reducing the cost of electricity production, partially eliminating the energy purchased with diesel and decommissioning government plants with high production costs that exceed operating life.
* Access to community satisfaction by improving electricity operating hours and ensuring the stability of the power supply of service structures from education, health and sanitation as well as for commercial construction.
* Reduce technical and non-technical loss by improving distribution networks, transmission lines and manufacturing plants.
* Increase the value of sales in power and payments, thereby raising the company's financial revenues and achieving a significant proportion of self-sufficiency to cover the operating expenses of electricity.
* By implementing this plan, we will have set the first building block towards achieving the overarching goal of providing sustainable electricity at an acceptable cost of production, efficiently and efficiently.
* **observation:**

Emphasis will be placed on the status of the system in the capital city of Aden to clarify the main problems affecting. The pathways of solutions will be implemented in accordance with the procedures agreed upon by those concerned, taking into account the specificity of each governorate with regard to operating resources as well as the data of the various sectors of the electricity system.

1. **First: Obstetrics**

The temporary capital, Aden, has been experiencing an accelerated increase in energy demand for many years and in the absence of projects to construct power plants and in line with demand has led to a large energy deficit that is growing annually. To remedy this deficit, the energy companies purchased were contracted on an emergency basis without starting to implement feasible strategic projects; Here we will work on a brief analysis of available, expected and targeted generating energy for next summer, bearing in mind that our plan will be in the same strategic direction.

**Target Generation (MW 450):**

* **PetroMasila plant:** PetroMasilaplant currently produces 100 megawatts and sends to the network 90 megawatts, this power is expected to be constant during next summer.
* **Floating steamer:** Procedures for leasing floating power are currently being completed, but due to delays in financial procedures due to scarce financial resources, contractual procedures have been discontinued and therefore exclude entry into service during the next few periods and require at least 9 months in case of resumption of financial procedures.
* **Government stations:** Most government stations suffer from a lack of chronic maintenance for lack of funding. Others produce energy at great cost and are not economically viable because they have exceeded their life expectancy and we aim to keep 100 megawatts in service for summer 2023.
* **Purchased power plants:** The purchased power plants distributed to more than 6 locations in Aden are intended not only to save energy but also to help solve the problem of power transmission and therefore based on current data we need to raise the contracted capacity to 200 megawatts for summer.

**Table showing the cost of obstetrics in Aden governorate**

|  |  |  |  |
| --- | --- | --- | --- |
| statement | Contractual capacity | The overall cost of energy +  Fuel consumed annually | Cost of production  Kw/hr |
| Current cost of energy purchased with diesel fuel | 100 mw/hr | 222,357,999 $ | 254 YER |
| Cost of current energy purchased with gasoline fuel (floating steamer) | 100 mw/hr | 134,537,600 $ | 154 YER |
| Cost of power produced from a power station PetroMasila | 100 mw/hr | 226,008,000 $ | 258 YER |

**\* If the floating vessel enters service, we have decided to eliminate 100 MW of the energy purchased for diesel fuel as a first phase \*.**

As planned for 2023, we will reduce power purchase contracts from the previous gross capacity of 175 MW to 50 MWh and the total value of the financial savings. However, for the difficulty of entering the ship, we are obliged to maintain the purchased power and the total contracting capacity:

* Total cost of energy production, according to the energy contracts purchased 175 MW continuous ($500,126,389) per year, including the value of fuel and energy purchased.
* The cost of referral of energy purchased with 100 MW capacity powered by gasoline fuel, including the installation of the transmission line to the receiving stations ($134,537,600).
* The current cost of energy purchased with diesel fuel at 100 MW is equivalent to ($999,357,222).
* Thus, the total value of financial savings for the same capacity and period ($399,820,87) for only one year.
* **Government Stations:**

Disposal of power purchase contracts and according to our plan will be in a gradual manner. What will contribute to the maintenance of the system is the maintenance of some government stations. We aim to maintain the plants urgently and our idea and through the savings we will work on.

After replacing the floating vessel instead of 100 MW of the energy purchased, we will benefit from the savings to buy and operate 25 MW power by directing this savings to maintain the government stations.

The 25 MW energy purchased without the cost of diesel fuel for operation will be approximately $7 million annually. This amount will therefore be apportioned to provide for the basic needs of government stations, bearing in mind that the savings will be at least a fourfold increase in this amount, especially since most of the target maintenance stations are powered by less expensive and more stable corrosive fuel in the network, Taking into account the poor condition of these stations due to the lack of timely maintenance procedures.

The maintenance of the stations through the provision of spare parts and consumables to the most efficient government stations currently will require approximately $20 million in preparation for the next summer.

**important observation**

|  |
| --- |
| Our plan above to address the energy deficit as well as the network and transportation lines, and therefore our plan is in parallel with the strategic plans. The urgent need to complete this plan will depend on reflection after the expiration of the floating ship contract and the completion of transportation and networking lines for all areas of the temporary capital Aden and the governors of Hajj and Abyan therefore, the need to start the procedures for the construction of a power plant powered by gasoline fuel in the capital Aden becomes an urgent necessity. If we start the procedures, it is expected that this target energy will be utilized during the summer of 24 and beyond.  This will ensure the actual disposal of the energy purchased as well as the suspension of the government plants with high production cost. This plant is a strategic imperative even if the second phase of PetroMasilaplant is completed.  (Not everyone is hiding the high demand for gas globally and currently the cost of production is almost equal to that of producing gas fuels and gasoline). |

1. **Second: Transmission lines and diversion stations**

The capital of Aden has also suffered from the lack of strategic transmission lines as well as transmission stations, even if they exist, it is suffering from the absence of modernization and development. Recently, the capital of Aden has witnessed the establishment of a bus line and transfer stations within the Petromasila project, which is considered one of the best achievements in this regard and we hope that the project and delivery will be completed soon in addition to breaking the bottlenecks in the network, it will help us to eliminate the power plants previously connected to the network for this purpose.

**Transfer lines and transformational stations:**

It is assumed that parallel works will be carried out by the Electricity Corporation via Petromasila, which is required to supply material and the cost of execution by the government or any external support, bearing in mind that providing these materials with government funding and routine procedures requires at least a period of time from 12 to 6 months therefore we recommend that urgent executive measures be taken to provide the materials so that we can carry out these workers before the beginning of next summer, bearing in mind that these immaterial has been submitted to the government 4 years ago and has not been decided for a moment.

**The high pressure network projects are divided by region in Aden into three main sections:**

**The first area:** Four major projects are listed in annex 1 at a total estimated cost of (13,527,300 US$).

**The second area:** Four major projects are listed in annex 2 at a total cost of (3,935,050 US$).

**The third area:** Two major projects described in annex 3 at a total cost of (1,408,600 US$).

* **observation:** The high-pressure network projects were raised as urgent projects that must be implemented before next summer, bearing in mind that the high-pressure network in the capital Aden needs more projects and strategic medium- and long-term network development.

1. **Third: Distribution Network**

The network in Aden also suffers from the lack of integrated projects, as work on them was random without planning and proper mechanism, there were patching operations that did not have any more than hoped, and there are corrective measures in this regard. No solutions will be found to all problems before summer 2023, but some will be focused on the project, which is completed, will reduce technical energy losses and will have a significant effect on reducing the technical waste through enhancing the network's strength and making it unusable for the simple commutations that are obtained.

In addition, the network of distribution in Aden and the other governors suffers a lot because of their lack of development and keeping up with the great urban renaissance in Aden and the other governors, and this is the main reason for the rise of the technical waste and making it easy even for the nettles, and in accordance with our strategic plan, we will work to ensure its improvement and development in accordance with the technical standards, depending on the region The main reasons for this imbalance are the technical overreach that took place in the past and because of the circumstances that occurred where there was no compliance with the regulations and the regulations, and also because of the non-development of these regulations, and we have already assigned specialized committees to ensure the movement and development of these regulations and their results that will become effective in the near future.

In preparation for the coming summer, and according to our plan, we will target priority areas that suffer from high technical waste, especially as most of the current transport operations of pressure have decreased beyond it. This loss is evident through technical readings and therefore the development of this network is considered a top priority. The needs are included in this report, as the estimated cost of this material in the third area of the capital of Aden is only $24,582,000 (Note that by providing 50% of these first-stage material, it will be very satisfactory for improvement, development and reduction of waste. (Facility statement)

1. **Fourth: The final consumer**

The regulations and regulations concerning the final consumption of electricity service are not updated on all levels, as only some adjustments have been made, in a complete manner, and as required by previous travelers in time, and the general orientation toward making these regulations flexible and changeable, and with the most significant changes in the cost of production, etc. this will be specifically assigned We will work on urgent measures and focus on some changes such as the cost of introducing electricity, procedures and others.

In addition to the potential savings from power generation at lower-cost stations and improving current waste through the completion of the transportation line and the conversion plans, starting with Petromasila, as well as improving the distribution network and reducing technical waste, we also aim at raising revenues, which will be achieved clearly through a significant increase in energy sales.

We have been focusing on many actions through which we seek to balance and reduce the gap between energy costs produced and sales, and through this plan, the gap between cost price and sales will be reduced through reducing the cost of production by relying on lower-cost power plants and reducing energy waste and, consequently, increasing sales.

1. **Fifthly: Suggestions and recommendations:**
2. **the establishment of a 300 MW central mazut station has been referred to fuel purchase stations and government overage commentary with an estimated value of 300 million dollars, with the following objective:**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Target Energy  Kw/hr | Fuel consumption rate  Liter per Kw/hr | Fuel required annually  (Mazut ton) | Fuel value rate  (ton) | Total fuel cost  Dollar ($) | Operating expenses of the station 20% | Administrative expenses 5% | Value of power produced for the grid | Cost of energy produced  Kw/hr/$ | Cost of energy produced  Kw/hr/YER |
| 3,000,000 | 0.216 | 551,115 | 450 | 248,001,750 | 49,600,350 | 12,400.087 | 310,002,187 | 0.118 | 130 |
|  |  | --- | --- | --- | --- | --- | --- | --- | --- |

1. Increase production efficiency and ensure energy production at the lowest possible cost and available in Aden.
2. Provide the cost of transporting fuel to the 16 stations within Aden governorate, as well as reduce the estimated cost of $1 million per month, equivalent to $ 12 million per year.
3. Save energy purchase funds as the cost of purchasing fuel-free power in Aden per month for contractual capacity 175 MW 4,410,000 USD and annual cost 52,920,000 USD.
4. Savings on accessories, auxiliary equipment, functional cadre and supervisory devices where the focus will be on a site for the central new station with the discontinuation of all other generating stations.
5. **Technical and non-technical loss reduction measures, where the total loss currently stands at 50% and the target of reaching 20%:**
6. New conversion stations with expansion and upgrading of existing conversion stations and linking them to the electronic system and central control unit.
7. Complete linking of 33 KM lines between all new and old stations.
8. Work on replacing some low pressure networks and connecting to international technical standards with the establishment of distribution stations with protection against indiscriminate tampering.
9. Work on fixing, connecting lines of distribution stations for the consumer (residential + commercial) with the introduction of the prepayment meter system.
10. Reactivate the network's technical and security control sector under the direct supervision of senior management by linking it to the central control unit and the operating room for electricity.
11. Amend the new linkage regulations, entries and work according to the single window system and connect them to the central control unit.
12. **Tariff and sale procedures:**
13. Moving the tariff of energy sales segments with their expansion in proportion to the country's situation to make this tariff automatically change with the variability of the cost of production and sale as the first stage, as the tariff will be raised during this period to 100%.
14. **Procedures for raising revenues:**
15. Strict control of collection management, according to clear indicators, and through this route will be easy to monitor daily revenue electronically.
16. We will work with other government agencies as a one-window system to stop any transactions to refrain from paying.
17. The increase in the percentage of income automatically by the decrease in the percentage of loss and this will be directly reflected in the increase in the rate of financial attainment.

**Comparison of the cost of energy production now and after the implementation of the plan**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Current energy production cost rate  Per Kw/hr | Total value of energy produced annually  (US $) | Production cost rate for energy after plan implementation | Total energy value after plan implementation  (US $) | Total annual cost difference after plan implementation  (US $) |
| 250 YER | $ 657,000,000 | 130 YER | $ 341,640,000 | $ 315,360,000 |

**Comparison of cost of loss now and after plan implementation**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Current loss rate | Total cost of loss per year  (US $) | Expected loss rate after plan implementation | Total cost of loss after plan implementation  (USD) | Total annual loss cost difference after plan implementation  (USD) |
| 50% | $ 328,500,000 | % 20 | $ 68,328,000 | $ 260,172,000 |

**Comparison of cost of energy sale now and after plan implementation**

|  |  |  |  |
| --- | --- | --- | --- |
| Current energy sales rate  Per Kw/hr | Value of increase in energy sales rate after plan implementation  (100% tariff increase) | Value of increase in energy sale rate  (Reduction of loss and conversion to 30% sales) | Energy sale rate after plan implementation  Per Kw/hr |
| 45 YER | 45 YER | 39 YER | 129 YER |

**Comparison of current and post-plan payment rate**

|  |  |  |
| --- | --- | --- |
| Energy repayment rate  Per Kw/hr | Energy reimbursement rate after plan implementation  (80% of energy sale value) | Total expected reimbursement after plan implementation  (As the loss rate is 20%) |
| 25 YER | 103 YER | $ 234,592,800 |

* **In order to ensure that the above procedures are achieved, we recommend that:**

To form a joint team of the Saudi Program for the Development and Reconstruction of Yemen, specialists from the electricity sector and related bodies to ensure that all the above are achieved transparently and in accordance with a time plan.

1. **closing summary:**

One of the most important reasons for the decline and collapse of electrical service is the failure to implement the necessary measures to improve it in a timely and integrated package.

The implementation of any unilateral decision will not have a clear and visible impact and will not achieve sustainability. Therefore, the objective of providing stable service with available resources and at the lowest possible cost.

We reiterate that this plan and these decisions, if taken, are exactly the same as the strategic plan. Actions if taken, are based on practical and realistic studies and experiences. We welcome any observations, proposals or even criticisms and are ready to modify the plan's course, if the proposals prove to be more efficient and effective.