Impacts of Covid-19's Health Crisis on the National Electricity Grid: The Contribution of Renewable Energies in the Defense Plan

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Abstract: Today the corona virus crisis reminds us of the vital role of electricity in our lives. It also gives an overview of our future and how can change. The current society relies on new technologies to survive; hence, the consumption of energy is more and more increasingly done in the form of electricity from wind and solar sources for some European countries and for Morocco also. The health crisis linked to the COVID-19 virus has a strong influence on electrical systems. In particular, electricity consumption dropped dramatically as soon as the containment measures were adopted. However, the evolution of electricity consumption is considered a good indicator of economic activity. Beyond this, the functioning of the electrical system and the continuity of electricity supply during this period of health emergency remains the concern of each network operator, the role of renewable energies becomes important to guarantee the supply of electricity during this crisis. In such a society, electrical security is essential to the thing that requires more stable and more flexible resources.

1 INTRODUCTION

The corona virus is transforming into an unprecedented international crisis, with serious repercussions on people's health and economic activity (Baldwin, 2020). The impacts of the corona virus pandemic on the electricity sector are harmful and measurable (FEIL, 2020), we can distinguish between two categories, short-term effects and other medium and long term. However, we can already identify some fairly intuitive tracks. The global impact of corona virus and the resulting turmoil in global markets dominate global attention.

The first section describes the need for access to electricity especially in the crisis caused by the coronavirus. The second part treats the description of the short term impacts. In the third part we describe the medium and long term impacts; finally, we identify the wind and solar potential in Morocco, how this form of energy can fill the gap and provide clean energy at lower cost.

2 THE GLOBAL CORONA VIRUS CRISIS HAS SHOWN US THE NEED FOR ACCESS TO ELECTRICITY

The health crisis we are experiencing today has shown us the importance of electricity. we are confined, teleworking remotely, using shopping sites for our purchases and websites for entertainment and finally television to be able to follow the courses programmed by the Ministry of education, for this a reliable power supply is necessary. The need for a reliable source for hospitals at this time of crisis where many sick people are refugees, thus the reliability of the flow of information between all members of society and the communication between doctors and patients is guaranteed thanks to electricity (Graff, 2020).

3 SHORT-TERM IMPACT OF CORONOVIRUS CRISIS

3.1 Continuity of Public Service

Electricity is a basic necessity in our life so ensuring the quality and continuity of the electricity supply is one of the essential tasks of the network operator. There is no fear on that side because the grid operator has plans which guarantee that the controllable plants will continue to operate, and that the transport networks will be in good working order. As distributors have set up, a system aimed at ensuring the continuity of services and limiting customers trips to the agencies of these distributors to the strict minimum. Priority is given to operational agents, those responsible for operating the power plants and maintaining the HTB and HTA lines. Thus, and throughout the period of the state of health emergency, the Distributors decided to postpone some activities at home, in particular, the counting, the distribution of consumption invoices and home collection. However, the Distributors announce that the interventions planned for network maintenance, during this period, will be limited to absolutely essential and urgent maintenance works. Permanent intervention teams will ensure the continuity of electricity supply in the best conditions of quality of service. Support agents can continue their telework activity.

3.2 Electricity Demand

Electricity demand fell 10% between March 9 and March 16 in France, mainly due to the drop in economic activity. The transmission system operator announced a trend of - 15% on March 18. It is the slowdown and in some cases, the shutdown of industry, shops and transport (TGV, metro, tram) that explain this decline and things should even get worse. The increasing use of digital technology due to tele-work and confinement (digital technology accounts for around 12% of electricity consumption in France and consumption in this sector would have increased by 40 to 50% in the context of the epidemic) should not offset the drop in demand for electricity in other sectors. The same scenario is probably expected for the North African countries like Morocco since their economy is focused on industry, trade and tourism, they could experience significant losses in 2020. So far, the main sectors affected are tourism, automotive and textiles (High Commission for Planning, 2020). Since the transport and transit of goods is operating normally, the impact of Covid19 on trade seems to have been curbed for the moment. The Four major sectors: industry, transport, services and households represent 80% of the demand for electrical energy. The energy demand of each of these sectors will be impacted (Delegation of the European Union to Morocco, 2020) and it's determined by one or more socioeconomic and technological parameters, the values of which are given as part of the scenarios. Take the example of a scenario where the forecast of electricity demand in 2020 has a trend of 41.72 TWh with a Peak of 6747 MW. The variation of electricity demand is schematized by the following Figure 1 bellow.

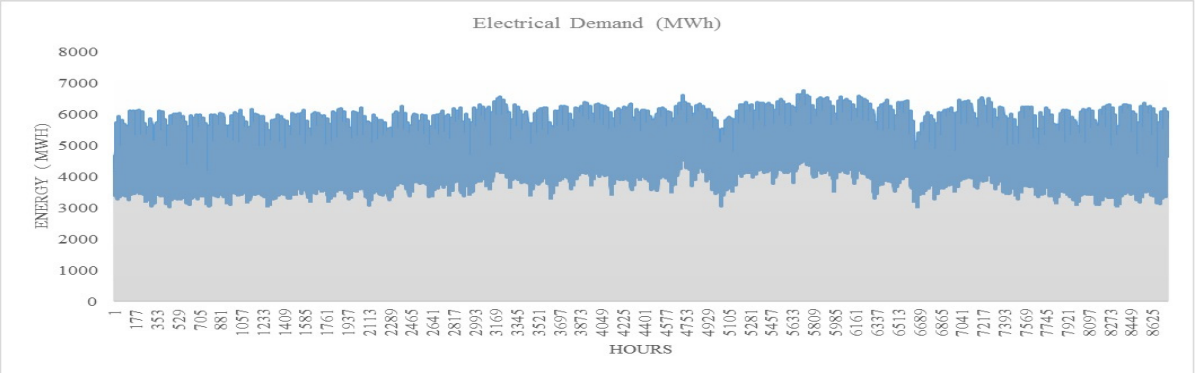

Figure 1: Forcast Electrical Demand of 2020

The variation in demand is between 6747 MW as the maximum value and 3032MW as the minimum value, the average value is 4750MW, this forecast is calculated on the basis of the achievements of the last ten years using the method of evolution of GDP and population. There are several methods for forecasting demand among them is cited in (Ziani, 2018).

The projection model that will be used is based on the evolution of GDP and POP according to the formula (1)

$$E=\alpha+\beta\ GDP+\chi\ POP \qquad (1)$$

E: Energy

GDP: Gross Domestic Product

POP: Population

The steps followed are:

- The evolution of GDP and POP
- Distribution by sector (%)
- Energy production of each sector (industrial sector….)

The basis for calculating changes in GDP by sector is the history of consumption by sector. According to (High Commission for Planning, 2020), energy consumption is divided into four main sectors, and the share of each sector evolves as follows Figure 2

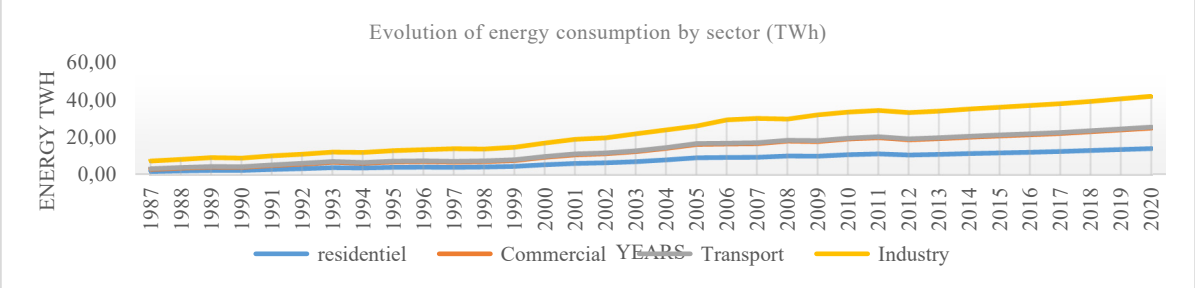

Figure 2: Historic of energy consumption by sector

GDP (Gross Domestic Product) is expected to decline by 1.8 % in the second quarter of 2020. This contraction is mainly due to a drop of almost half the growth rate of the added value of the tertiary sector, following an almost total halt in the catering and accommodation activities, of a reduction of 60% activity in transport and 22% in trade, compared to our reference scenario. The slowdown in services would be combined with a 0.5% contraction in the added value of the secondary sector. Manufacturing industries would be the most affected by the decline in foreign demand for Morocco, with the drop in production in the automotive, textile and electrical industries. At the same time, mining activities are expected to experience reduced demand from the chemical industries, in the wake of the sharp decline in phosphoric acid exports. As for agricultural activities, their decline would be limited to 2.9%, on an annual basis, thanks in particular to the improved growth prospects for spring crops, favored by the almost general return of precipitation at the end of March and the stabilization of prices. The effects of this climatic impulse should however diminish, in the face of an extension of the restrictions on the movement of seasonal workers and the maintenance of the strict control measures imposed by European countries beyond April 2020, particularly for production perishable like fruits and vegetables. The effects of containment during the month of April 2020 should reduce GDP growth by 3.8 points in the second quarter of 2020 compared to the first scenario, equivalent to a loss of around 10.9 billion dirham, instead of 4.1 billion dirham a quarter earlier. Services should contribute the most (-2.49 points), followed by manufacturing industries (-0.39 points).

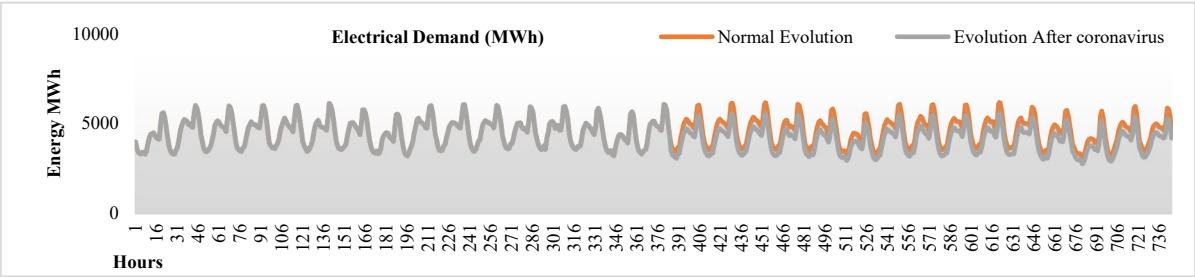

Figure 3: Electrical Demand of March 2020 with the impact of the health crisis of coronavirus

It should be noted that these forecasts remain subject to more or less significant revisions as new data are published, in a context marked by great uncertainties as to the duration of the health crisis, with harmful effects on the economic activity of the various containment and travel restriction measures, but also with regard to the magnitude of the impact of spending programs and plans to support the national economy (High Commission for Planning, 2020). By an application of this reduction the charge curve for the month of March of the year 2020 will have the form as follows, Figure 3. The load curve for 2020 will be of the following form, let's assumes the impact of the corona virus crisis on industrial activity will end in June, Figure 4 bellow. If we zoom on the three months March, April, May and June we can clearly see the decrease in demand Figure 5 bellow.

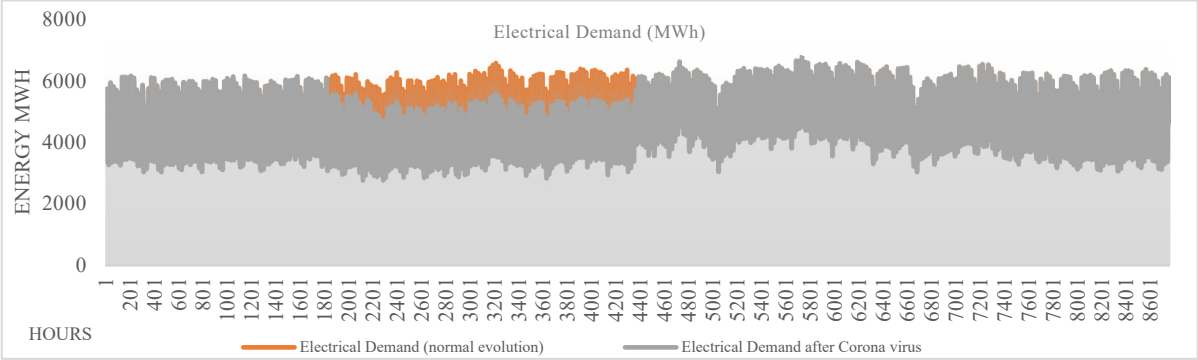

Figure 4: Forecast Electrical Demand of March-April-May-June after the impact of the health crisis of coronavirus

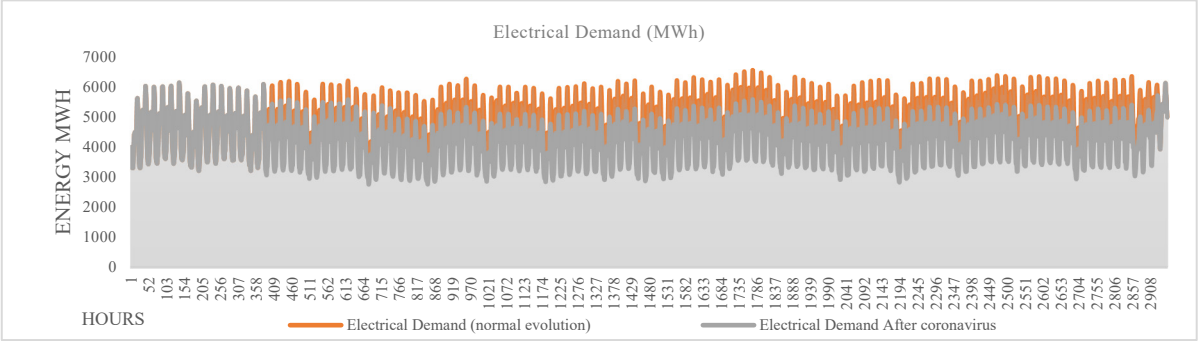

Figure 5: Forecast Electrical Demand of March-April-May-June after the impact of the health crisis of coronavirus

4 MEDIUM AND LONG TERM IMPACTS

4.1 The Production Plan and the Adequacy Supply-demand

With a trend in lower demand for electricity, the problem of electricity generation capacity will not be imposed. Balancing supply and demand in real time is one of the most difficult equations for network operators to solve; incidents occur when demand exceeds supply. But the most dangerous incidents have taken place during periods of low demand.

4.2 Electricity Supply Security, Flexibility and Renewable Energies

In most of the countries that have taken strong containment measures in response to the corona virus, the demand for electricity has dropped significantly (15%) and this is due to the decline in economic activities. we can cite as examples Spain and Italy, where its production consists primarily of wind and solar. with the confinement conditions that we are experiencing today or the demand for electricity decreasing rapidly while the weather conditions remain the same, the share of renewable energies is increasing. the recent drop in demand for electricity has given the opportunity to advance power systems by boosting them to levels of wind and solar power

that they would not have had without another decade of investment in renewables (Das ,2020). the health crisis has enabled us to understand electricity systems, including some of the operational challenges that grid operators face in ensuring the security of electricity.When wind and solar electricity meet most of the demand, systems must maintain their flexibility so that they can quickly increase other sources of production when the supply model changes, such as when the sun goes down. A very high share of wind and solar energy at any given time also makes it more difficult to maintain grid stability.This problem doesn't apply to the countries of North Africa like Morocco since their production plan is not 100% based on renewables energies at this stage and since production based on conventional power plants reaches 70% total need for country. Taking the example of Morocco, with a forcast demand is 41.72 TWh and a production plan as follows, Figure 6. it is clear that this production plan contains very flexible means to meet the demand for electricity, the problem of security and stability of the electrical system will not be imposed, Figure 7.

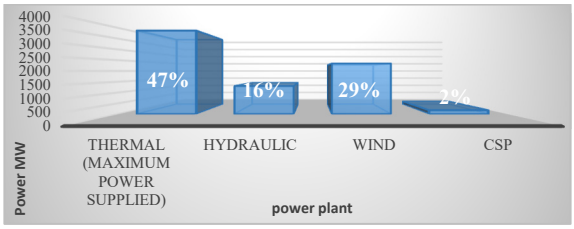

Figure 6: Production Plan of 2020

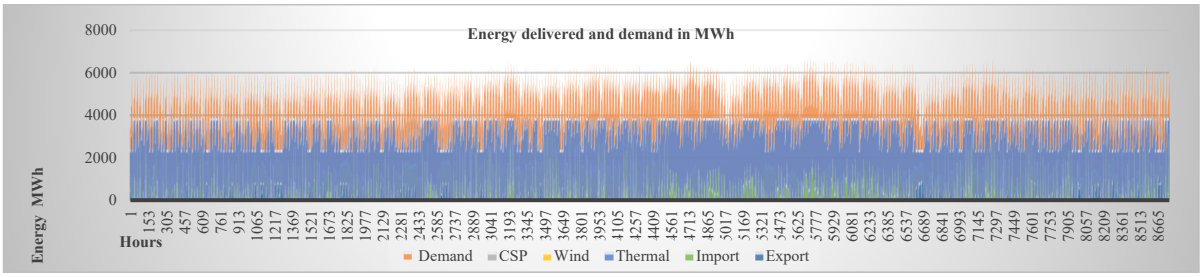

Figure 7: Forecast distribution of demand and production normal year 2020

Wind and solar can keep the power grid flexibility, and systems increasingly rely on them. Demand decreases at night hence the reduction in wind power, unlike solar power can be reduced at midday when there is more energy demand. Following technological development, the production of electricity from renewable energies will not be limited to climatic conditions but will have to be intelligently managed according to more reliable forecasting methods in order to reduce costs and improve electrical safety.

The drop in electricity consumption leads to a drop in the production of the most expensive sectors, namely that of thermal power plants (gas and coal) over some particularly slack periods. This mechanically leads to an increase in the share of renewable energies in the electricity mix. the rate of integration of renewable energies increases mechanically because the functioning of the electricity markets leads to operating as a priority the means of production at zero or very low variable cost such as wind, solar or hydraulics. Consequently, the instantaneous share of production cover by renewable energies can reach higher levels depending on the installed capacity, which is around 2528MW in 2020. Morocco is accelerating its evolution towards energy mixes with a strong component of renewable energies (the target set is 52% by 2030, including 4560 MW solar, 4200 MW wind, and 3100 MW hydroelectric), which will not fail to encourage the energy independence of the country (Azeroual, 2018). The distribution of the solar and wind potential over the year according to the climatic conditions is as follows [1h; 8760h] Figure 8 bellows.

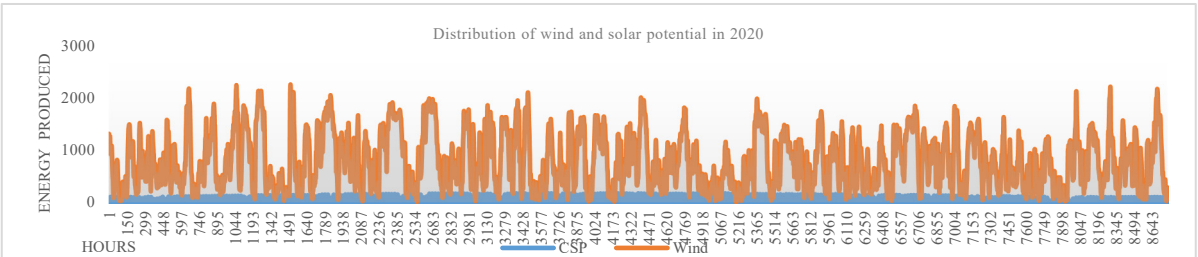

Figure 8: Distribution of Wind Potential in 2020

5 CONCLUSION

The millions of people in Africa live without access to electricity which makes their lives more difficult, vulnerable to risks like disease. The health crisis reminds us of the importance of electricity in our lives. It also gives a insight into its evolution in the future. Today, we live in a society that relies even more on digital technology for everyday life, where energy consumption takes up a large place and depends on renewable sources such as wind and solar. In such a society, electrical security is the foundation of prosperity and stability, but this can only be guaranteed with the great efforts of governments.

Despite the massive use of digital technologies in electrical systems, the corona virus crisis has also reminded us of the role of skills and qualified personnel. Maintaining and repairing the network requires a lot of manpower and experience. Organizations must ensure that staff members stay safe while they are performing their critical work. A key lesson from the current crisis is to ensure that electrical systems have sufficient resources not only in physical assets but also in human capital.

The curves shown in this article are the results of the analyzes of the evolution of the load during the pandemic period, the methods used are well defined in the article, such as linear regression using GDP and POP.

The insufficiency of electricity can be solved by using other techniques of electricity production such as solar and wind sources, the production of energy in Morocco doesn't depend only on conventional energies, however the mix energy is very rich by renewable energies (solar and wind) and this is the case for Brazil and other countries during the pandemic period.

The impact of the reduction in mobility due to the situation of confinement on the Moroccan energy bill has been clearly noticed, we have seen a drop in consumption for industrial and tertiary activity unlike the consumption of houses which has been changed from 'significantly. Taking the example of a feeder supplying a household zone, the normal load is 4.5MVA, during confinement the load has been changed to 5.8MVA. Unlike a feeder which supplies an industrial zone, the normal load is 6.5MVA has been lowered to 4.2MVA. Today Morocco invests in energy storage means such as pumped storage power plants, Thanks to their storage function, these installations help to maintain the balance between production and consumption on the electricity network, while limiting production costs during peaks in consumption. Today, the transfer of energy by hydraulic pumping is the most mature technique of stationary energy storage. Existing plant: Afourer 464MW; Future power plant: 1150MW.

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