Заключение

В результате проведенной работы были актуализированы характеристики шлаков и методика расчета, которыми можно воспользоваться при проектировании реакторов ВВЭР на других уровнях мощности, так как потери реактивности за счет шлакования реактора ВВЭР в разных группах изменяются по схожим зависимостям, а мощность реактора влияет только на интенсивность потерь реактивности. Вначале кампании основной вклад в потерю реактивности вносят шлаки первой группы, что связано с быстрым нарастанием концентрации сильных шлаков до их стационарных концентраций.

В реакторе типа ВВЭР-1200 с тепловой мощностью 3500 МВт, при степени выгорания 35 %, потери реактивности за счет шлакования не превышают 4 %, что влияет на продолжительность кампании реактора.

Уточнение параметров шлакования значительно повышает точность определения потерь реактивности, что позволяет повысить эффективность эксплуатации ядерного реактора.

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NPP POWER UNIT FOR THE CITY OF ALEXANDRIA WITH A DESALTING PLANT

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Introduction

Sustainable development is the main goal of the whole world and it is not forgotten that energy is the main engine and the active element for all growth and development, as it is the basic element for all sectors of the economy and a companion to human life. In an attempt for Egypt to enter this race, the government is working on increasing the supply of electricity generated using nuclear energy. Usually it is used in cities that overlook a natural source of water such as the Nile River or any of the seas overlooked by Egypt, the Mediterranean or the Red Sea. Since the salinity of these two seas is high and contains chemicals, so a desalination and treatment plant must be established for these Water before entering the plant in order to ensure that no damage or loss of efficiency occurs due to corrosion of the internal surfaces of thermal power equipment, as well as without the formation of deposits on the surfaces of heat transfer, sludge in equipment and pipelines.

The purpose of the project

This project aims to replace the dilapidated Abu Qir power station in Alexandria city (figure 1), which used to work with coal as fuel, and to establish a 650 MW nuclear power station in its place, equipped with a desalination and water treatment plant, based on a decision issued by The head of the Egyptian Electricity Holding Company stipulates the beginning of the implementation of the plan to degrade and stop the aging power plants, whose operational life exceeded 27 years, due to their increasing consumption of fuel, and their lack of need at the present time [1].

Fig. 1. Alexandria city (Abu Qir sector) [2]

Justification of the choice of location

In implementation of the decision that was presented above, there were more than 4 stations that were stopped, including the Abu Qir station in Alexandria, which this project aims to replace, And I chose this one specifically to replace as there are more than one power plant has been shut down next to this one, so this region will need more energy production to cover what has been stopped in the coming days and on another hand I choose this area at Alexandria because of the availability of all the ingredients that we can need to establish a nuclear power plant from a source of water as it overlooks the Mediterranean Sea and the availability of a large area to contain the power station and the desalination station. At the same time it is somewhat far from the residential communities in order to avoid any radiation that may be emitted from the station.

Parameters and schemes of the project

An attempt to cover the same amount of energy that was produced by the old station, and based on the climatic condition of the place, such as the average temperature and atmospheric pressure, it reached the following initial parameters at table 1 which the project calculations were based on.

Table 1. Initial parameters of the project

N_e, MW	650
$t_{cooling\ water}$, °C	30

By working on the initial data I got all the remaining parameters of the station and designed the suitable scheme for it (figure 2). And after calculating all the flow rates in the station I managed to design the suitable scheme for the desalination plant (figure 3), which covers the flow rate of leakage which at our situation G_{leak}=11,5 kg/s.

Main results of the project

At this project I designed an NPP with electrical power 650 MW. The steam turbine has HPC and LPC between their one separator and one stage of superheating. Finally with these components the efficiency of the plant is 29 percent. The number of LPFH is 4 and HPFH is 3. With this calculation the final parameter of the plant shown in table 2.

Table 2. Final Parameters for the NPP plant

Parameter	Value	Parameter	Value
Q_{SG}	2106,8·10^3 kW	G_0	1152 kg/s
turbine efficiency	31,2 %	Gross efficiency of NPP	30 %
Net efficiency of NPP	29 %	efficiency of steam generating unit	97 %

After that choosing the suitable material for each equipment according to my calculation, my choice should include technical and economic properties.

I also designed the desalination plant with the elements (table 3).

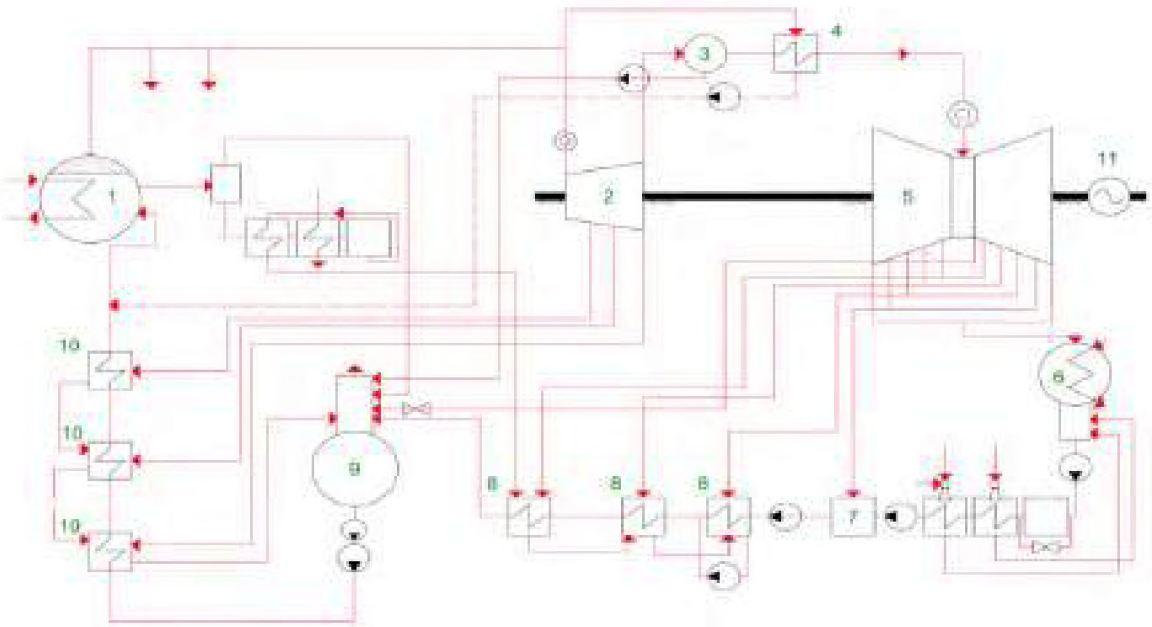

Fig. 2. Scheme for NPP plant:
1 – steam generator, 2 – high pressure turbine, 3 – separator, 4 – reheater, 5 – low pressure turbine, 6 – condenser, 7 –open low pressure heater, 8 – closed low pressure heater, 9 – dearator, 10 – high pressure heaters, 11 – electric motor

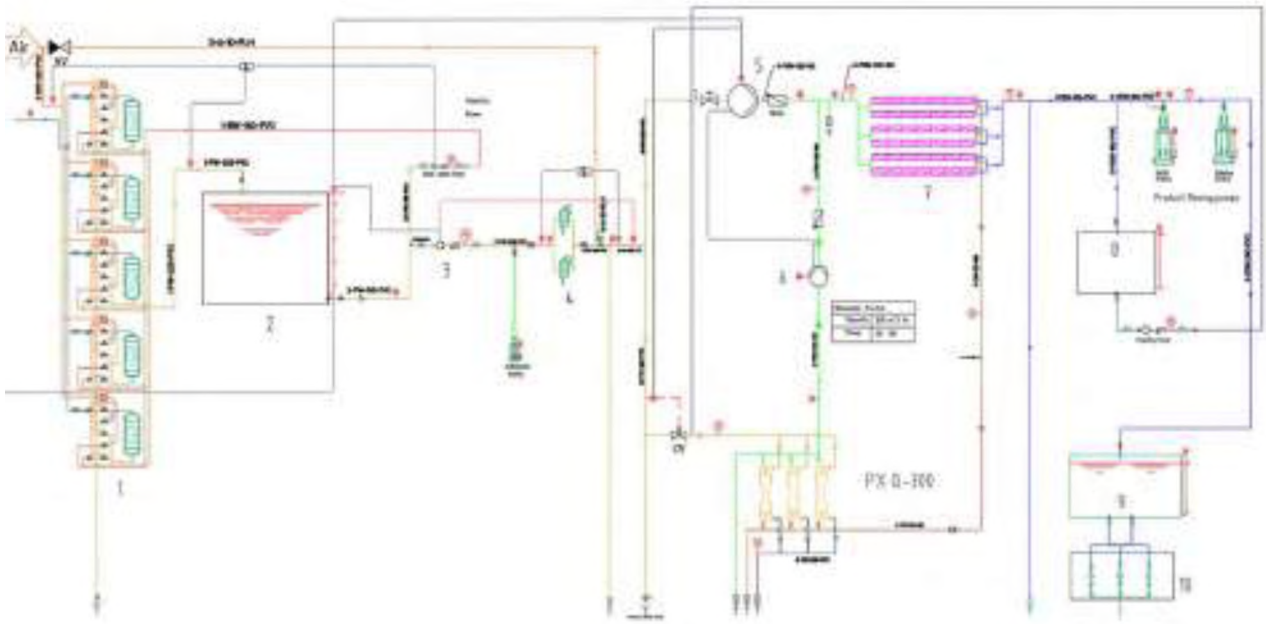

Fig. 3. Scheme for desalination plant:
1 – Sand filters, 2 – Raw water tank, 3 – Feed pump, 4 – Fine filter, 5 – HPP, 6 – booster pump, 7 – pressure vessel, 8 – flushing tank, 9 – permeate tank, 10 – permeate pumps

Table 3. Final Parameters for the desalination plant

Name of the element	Quantity of elements	Power, m^3/hr
Sand filters	5	49.1
Feed pump	1	145
HPP	1	55
Booster pump	1	125
Fine filters	2	30
Pressure vessels	15	
Membranes	90	

Conclusion

In this project we developed a nuclear power plant as an alternative to a thermal power plant that has spent its life and that effects on the reduction of CO_2 emissions into the atmosphere which helps to preserve the environment. We have presented the calculations of the project for the construction of a complete nuclear power plant in addition to a water desalination plant to support this plant. It can also be benefited from the water desalination plant for civil use and be a source of potable water.

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ADVANCED TURBINE REGENERATION SYSTEM WITH DIFFERENT NUMBER OF HIGH-PRESSURE HEATERS

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Introduction

The course of the globe is changing. Our world continues to be heavily dependent on fossil fuels despite the significant efforts to decarbonize the economy and the many billions spent on those initiatives. Over 80% of the world's energy still comes from fossil fuels, and the trend is clear: rather than reducing our reliance on fossil fuels, we are growing it. A global initiative is in way to create a sustainable energy system. The demand for clean, plentiful, and affordable electricity is at the center of this initiative.

The utilization of nuclear energy offers a quick pathway to a high-powered, clean energy system that is inexpensive, results in a healthier environment, and increases a nation's energy security.

The only low carbon technology that has been shown to work and can be implemented at the pace and scale necessary to meet the goals of the Paris Agreement are large-scale nuclear reactors. Regardless of the weather or the time of year, these reactors quietly operate in the background while providing enormous amounts of power constantly. The operational performance of nuclear energy is outstanding on a global scale, with many reactors achieving capacity factors above 80% on average.

Current nuclear power facilities throughout the globe are built on tested technology that has developed and matured over the past 40 years. These reactors, which have capacities ranging from roughly 600MWe to 1700MWe, offer their national systems a safe and reliable source of electricity.

This project's objectives included developing a nuclear power unit with 900 MW, figuring out the best way to balance efficiency and economic concerns, and upgrading the nuclear power plant's Feed water heating system – heat regeneration. These developments were necessary because they would meet the needs of countries in the Middle East and South Asia.

1. Heat regeneration for the feed water heating system

The feedwater heating system typically includes:

- low-pressure feedwater heaters;
- deaerator;
- high-pressure feedwater heaters.