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NPP Construction Economic Benefits For Uzbekistan

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Abstract— *This article also presents the question of the effectiveness of the joint commission at the level of heads of government as a tool for developing cooperation. Recall that it was created in October 2018 following the negotiations between Shavkat Mirziyoyev and Vladimir Putin. "The joint commission at the level of heads of government is not a completely new instrument, but in fact the modernization of the previous power units of thermal power plants and the construction of a nuclear power plant in Uzbekistan.*

Keywords—atom, strategic, implementation, cluster, partnerships, international, regional, launch, power unit, raw materials, pace.

1. INTRODUCTION

NPP is a very modern and timely project. The economy and population of Uzbekistan are growing rapidly, and more and more electricity is needed. And the republic is doing well with the raw materials for nuclear power plants - it ranks twelfth in the world in terms of uranium reserves and seventh in terms of uranium production. The most important step was the launch of the construction by Russian forces of the first nuclear power plant in Uzbekistan, made during the state visit of Vladimir Putin to the republic. The $ 11 billion project involves the construction of two power units with a total capacity of 2.4 MW. On October 19, 2018, a solemn meeting was held dedicated to the start of the project for the construction of the first nuclear power plant in Uzbekistan. The cameras of the press services captured a historic moment: the presidents of the two countries simultaneously pressed the symbolic button to launch the project. Specialists of the Uzatom Agency (Uzbekistan) and the State Atomic Energy Corporation Rosatom (Russia) announced the start of engineering work to implement the project. "Today we are opening a new strategic area of cooperation with the Russian Federation - the development of nuclear energy. This project forms a new cluster, its implementation will serve to further develop industrial potential and create new jobs in various sectors of the country's economy", Shavkat Mirziyoyev said.

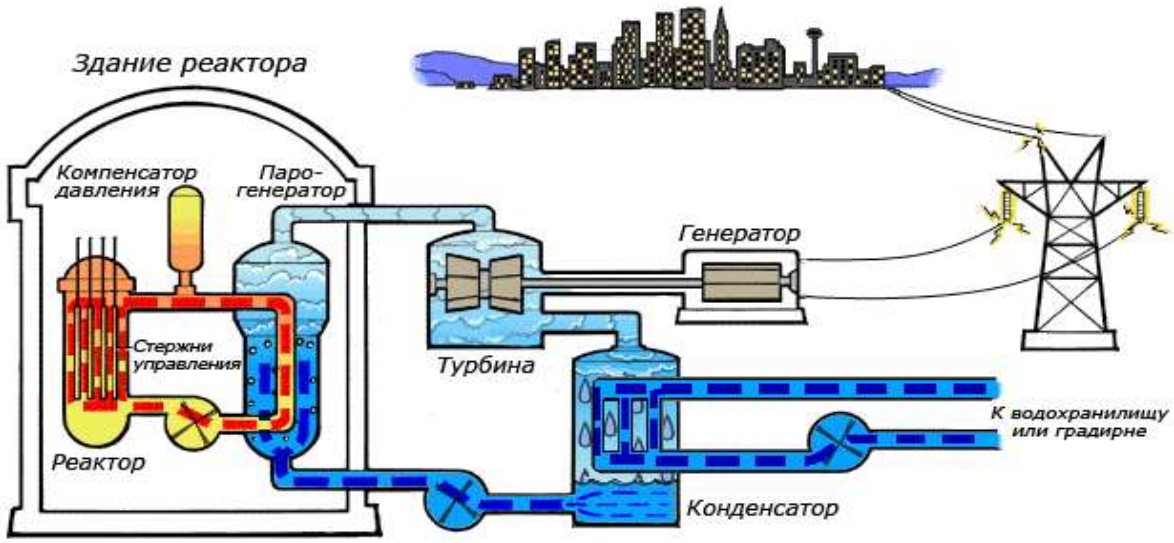
2. MAIN PART

According to the intergovernmental agreement, construction of a nuclear power plant is envisaged in Uzbekistan, which consists of two power units with VVER-1200 reactors of the "3+" generation. The total capacity of the station is 2.4 GW, which is about a fifth of the total electricity generated in the republic. VVER-1200 reactor cycle:

1. Provides work in fuel cycles lasting from 12 to 18 months;
2. Provides for the possibility of extending the fuel cycle through the use of temperature and power effects of reactivity for a period of up to 60 days;
3. Provides an increased level of fuel burnup at the level of 70 MW days / kg uranium on average for the maximum burned-out fuel assembly.

Fuel assembly design:

1.It is maintainable;
2. Provides the ability to remotely remove and replace a defective fuel element using simple repair tools.
3. Replacement of a defective fuel element using simple repair tools.
4.Uranium gadolinium fuel UO2-Gd2O3 is used;
5. The temperature of repeated criticality is provided - less than 100 ° C;
6. The mass of fuel loaded into the reactor has been increased due to the improvement of the fuel elements.



1-fig. General view and principle of operation of a nuclear power plant

The project is being implemented jointly with the Russian state corporation Rosatom. The estimated cost of construction of the nuclear power plant will be about $ 11 billion, the launch of the first power unit is planned in 2028.

Currently, Uzbekistan is actively working to create a legislative framework to ensure the safe use of atomic energy in accordance with the best world practices. The second stage of exploration work has begun at the priority site near Lake Tuzkon in the Jizzakh region. However, this is not yet final data, the full cycle of surveys is planned to be completed by 2020. Next, it is planned to obtain a license to locate the station at the selected site, after which the design stage of the station itself will begin, and only then - the construction itself.

Not only Uzbek and Russian specialists are involved in engineering surveys, but also international experts, and the whole process is implemented in accordance with international requirements and standards. The main task is for the site to comply with all IAEA standards for the sake of the top priority - ensuring safety.

Currently, all the forests of the planet absorb about 2.5 billion tons of carbon dioxide per year. If all the operating nuclear power plants in the world today were replaced by gas or coal, they would emit 2 billion tons of carbon dioxide per year. It turns out that nuclear power plants are practically the second lungs of the planet. This fully fits into the current trends in the formation of a low-carbon energy balance, where nuclear power plants are a source of base load with a stable, predictable and, importantly, attractive electricity price.

Uzbekistan pays great attention to personnel training, and in this we are actively cooperating. On September 3, 2020, a branch of our university, NRNU MEPHI, was opened in Tashkent, which is recognized as one of the best in the world. Thousands of young people can get a good education. This will then allow them to find work in a high-tech field, such as nuclear energy, or in related engineering fields.

One workplace at a nuclear power plant, on average, creates up to 10 jobs in the infrastructure: builders, operating personnel, scientists, maintenance personnel, and so on. This is a good job that gives confidence in the future. Taking into account the international experience in the construction of Russian nuclear power plants, it is estimated that one dollar invested in nuclear power plants under the Rosatom project, which includes 2 VVER-1200 reactors and localization at the level of 20-30%, can bring $ 1.9 to local suppliers, $ 4.3 The country's GDP and 1.4 dollars to the budget in the form of tax revenues.

Of course, nuclear generation is an important factor in ensuring the state's energy security for decades to come. In fact, today nuclear power is the only affordable, reliable and environmentally friendly source of energy capable of providing stable base generation.

The following indicators:

1.Electric power of the unit is 1200 MW;
2.Efficiency (efficiency, gross) - 35.9%;
3. The service life of irreplaceable equipment is at least 60 years;
4. Increased fuel efficiency;
5. The coefficient of technical utilization, averaged over the entire service life of the NPP - 92%;
6. The coefficient of utilization of the installed capacity, averaged over the entire service life of the NPP - 90%;
7. Use of modern fuel cycles;
8. The duration of the overload period is up to 18 months.

Calculation of technical and economic indicators and expected results of NPP
Energy capacity of one NPP unit.
Ne=1200 mVt;
Enrichment of nuclear fuel (medium):
Xn=21%;
Efficiency Gross;
□br=40,8%;
average combustion depth:
Bo'r =70° mVt·kun/t;
Power utilization factor $\varphi = 0{,}7 \cdot \frac{500}{820}$
cost of 1 kg of conventional natural uranium
Sceб=500 rub/kg = Syc.уран
Electricity consumption own needs:
Kc.н =6,1%;
1. Annual consumption of nuclear fuel:

$$G^x = \frac{N_e \cdot 365 \cdot \varphi}{\eta^{br} \cdot \beta_{o'r}} = \frac{600 \cdot 365 \cdot 0{,}7}{0{,}408 \cdot 10^{-5}} = 3{,}384 \frac{t}{\text{год}};$$

2. Conditional price of uranium enrichment:
Sобог = Sразные затраты·fe1,3
Here – fe expense ratio;
fe = (Xн – Xo) / (Xe – Xo);
Xe -U235 natural uranium storage;
Xo -U235 garbage storage;
Senrichment=500·((21 –0,25)/(0,71–0,25))1,3=70,515 so'm/kg;
(TVEL) – Technical highlighting element:
STVEL = 0. 3 · Sboyitish = 0,3 ·70515 = 211,545 so'm/kg;
3) Annual additional enrichment of uranium conditional nuclear fuel if 1%:
Ufuel=Gx·103·(Sобогощ+STVEL+0.1·Sобогощ)=3,384·103·(70515+21154,5+
+0,1·70515) = 334071860 so'm/kg;
Making up the price of fuel:
Ст = Uyoq/(Nэ·103 ·365·φo'r·(1 – kn. e. q)·24 = 334071860/(600·103·365·0,7·(1 – 0,61)·24) = 0,097 so'm/kVt·час;
5) Depreciation capital average standard A= 4,7%, k=120 so'm/kVt·час:
Ua = k·Nэ·103 ·(A/100) =12000·600·103·(4. 7/100) = 338400000 so'm/год;
6) Establishing staffing factors for start-up operations per person ksht =0,7 man/mVt, average salary =2400000 so'm / year.

Ui. x = Ne·kшт·Ф = 600·0,7·24000 = 10080000 so'm / year;
7. Depreciation deductions for seasonal repairs 40%:
Uрем = 0. 4·Ua = 0,4·3384000 = 135360000 so'm / year;
8. Miscellaneous costs of wages, depreciation deductions, working hours, adjustment, repairs are taken from the total costs, 30% is allocated:
UMiscellaneous costs=0.3·(Ua+U salary +Utam)=0,3·(338400000+10080000+135360000)= 145152000 so'm / year;
Ustart work=(Uamar+Usalary+Urepairs+Umiscellaneous expenses+Ufuel)
=(338400000+10080000+135360000+145152000+334071860)=963063860 so'm / year;
9) The cost price of 1 kVt h of electric power (component costs):
a) Compiled fuel costs:
(Стоп/Сэ/э)·100% = (97,0/1,28)·100%=75,78%;
b) Compilers amortization costs:
(Ca/Сээ)·100% = (0,09794/0,28)·100%=34,98%;
v) payroll compilers:
(Сз.п./Сээ)·100% = (0,0036/0,28)·100%=1,3%;
g) Repairs compilers:
(Срем/Сэ/э)·100% = (0,03918/0,28)·100%=13,98%;
d) compilers miscellaneous expenses:
(Ср/р/Сэ/э)·100% = (0,04223/0,28)·100%=15,08%.
10. Cost price 1kVt / hour of electric power:
Сээ = Uпускав.раб/(Nэ·103·365·φo'r·(1 – ksh. ex)·24) = 963063860/(600·103 365·0,7·(1–0,61)·24)= 128 so'm/kVt·ч ; [23]

3. CONCLUSION

1. The construction of a nuclear power plant is a long-term project that will unite Russia and Uzbekistan for the next century.
2. At present, all the forests of the planet absorb about 2.5 billion tons of carbon dioxide per year. If all the operating nuclear power plants in the world today were replaced by gas or coal, they would emit 2 billion tons of carbon dioxide per year.
3. NPP fully fits into modern trends in the formation of a low-carbon energy balance, where NPP is a source of base load with a stable, predictable and, which is important, attractive electricity price.

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