

Steam generators and heat exchangers

INTRODUCTION



Curriculum

(in an spring semester)

- Lectures – 24 h.
- Practical – 8 h.
- Laboratory classes– 16 h.
- Current control is 2 tests.
- Final control are credit and exam.

Note. *In the 2nd term (spring semester) there must be carried out the course project.*



Teachers for this discipline

- Slyusarskiy K.V., associate professor (lectures, exam).
- Vorobyov A.V., associate professor (practices, labs).

Subject and objectives of the course

The **subject** of the study is a steam generator of the nuclear power plant (hereinafter – NPP SG or SG).

The main objectives of the course:

- study of the NPP SG operation principle;
- experience of the NPP SG basic designs;
- obtaining design skills for the efficient NPP SG construction;
- mastering the principles of the NPP SG safe and economical operation.

CURRENT STATE AND PROSPECTS OF NUCLEAR ENERGY DEVELOPMENT



The role of electric power in people's lives

Electrification is essential for:

- ❖ social and economic progress of society;
- ❖ improvement of working conditions;
- ❖ acceleration of scientific and technological progress;
- ❖ labor productivity growth, etc.

The most important indicator of electrification is **per capita electricity consumption**, kWh / (people per year)

POSITION	COUNTRY	PER CAPITA ELECTRICITY CONSUMPTION, KWH / (PEOPLE PER YEAR)
1	Iceland	51439.909
2	Norway	25175.221
6	Canada	15137.424
9	USA	13393.901
16	Japan	8394.124
22	France	7728.553
23	Germany	7215.421
28	Russia	6430.623
62	China	2943.790
81	Egypt	1607.930



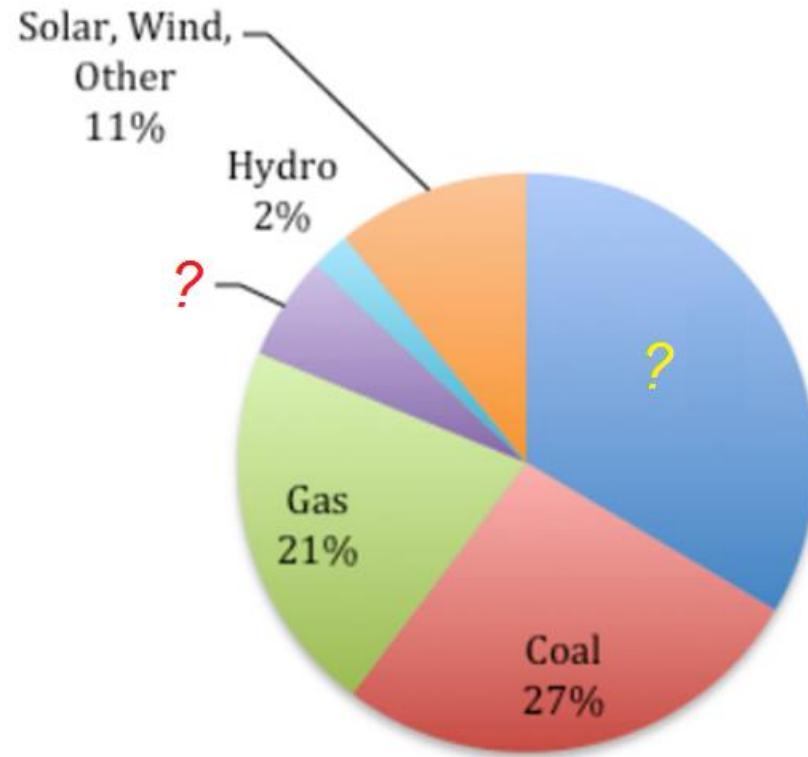
QUESTION

What factors affect of per capita electricity consumption, kWh / (people per year)

ANSWER

1. Level of industrial production
2. Climate

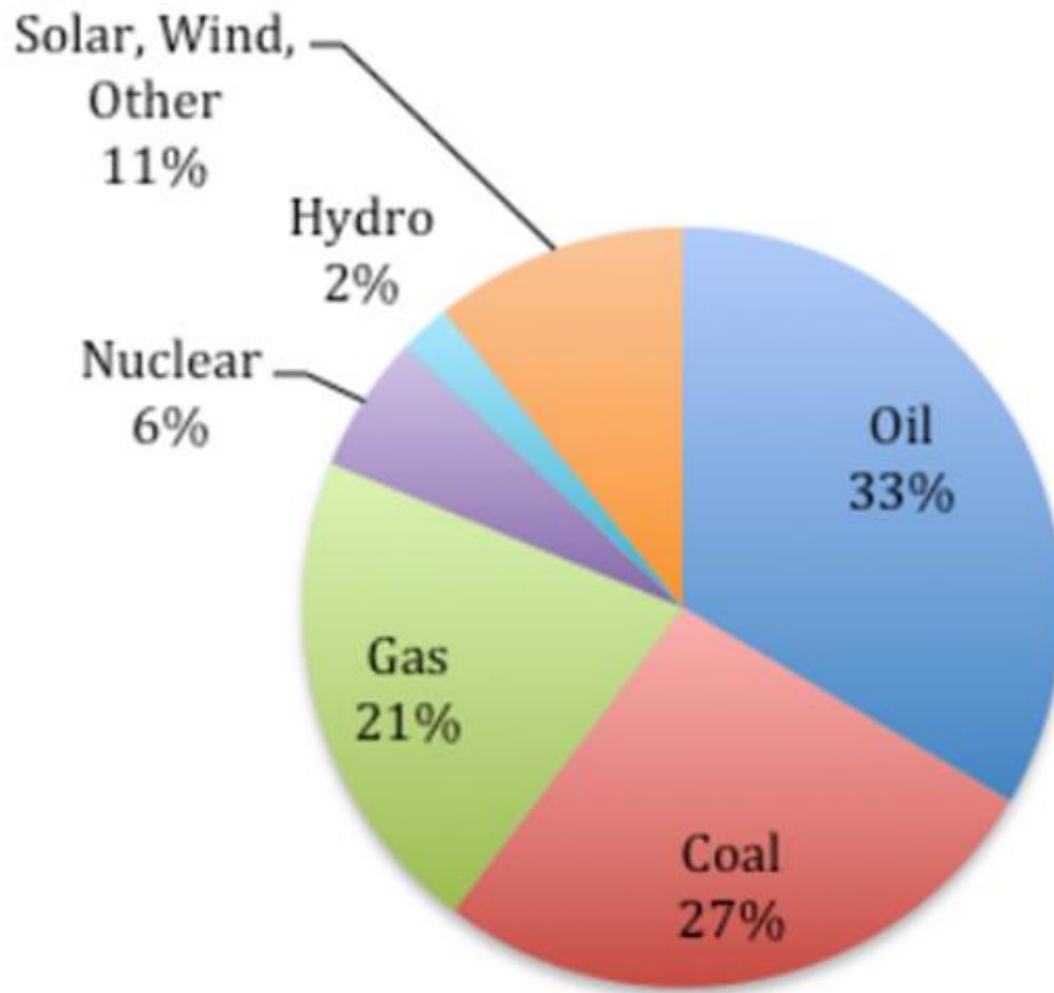
The role of different energy sources in the world energy production (2011)



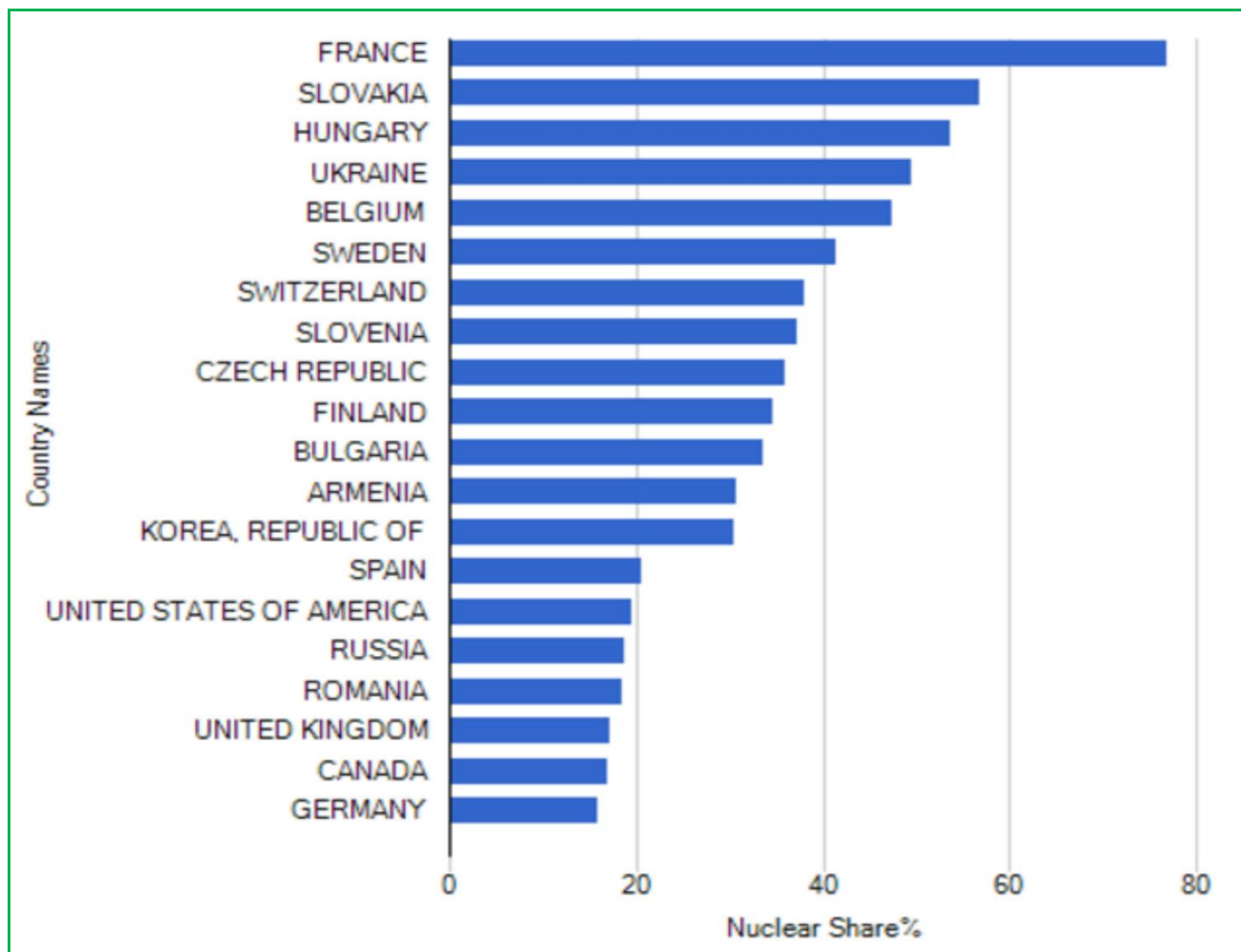
Question.

What did I forget to indicate in this picture?

The role of different energy sources in the world energy production (2011)



Nuclear power generation share (2014)



The use of nuclear power in the industrialized countries of the world (2014)

Country	Installed nuclear capacity, MW	Nuclear share of electricity production, %
USA	99,238	19,5
France	63,13	76,9
Russia	24,654	18,6
Japan	42,388	0
Canada	13,5	16,8
Germany	12,074	15,8

The world's largest nuclear power plants

Kashiwazaki Kariwa NPP

7 units, 8200 MW

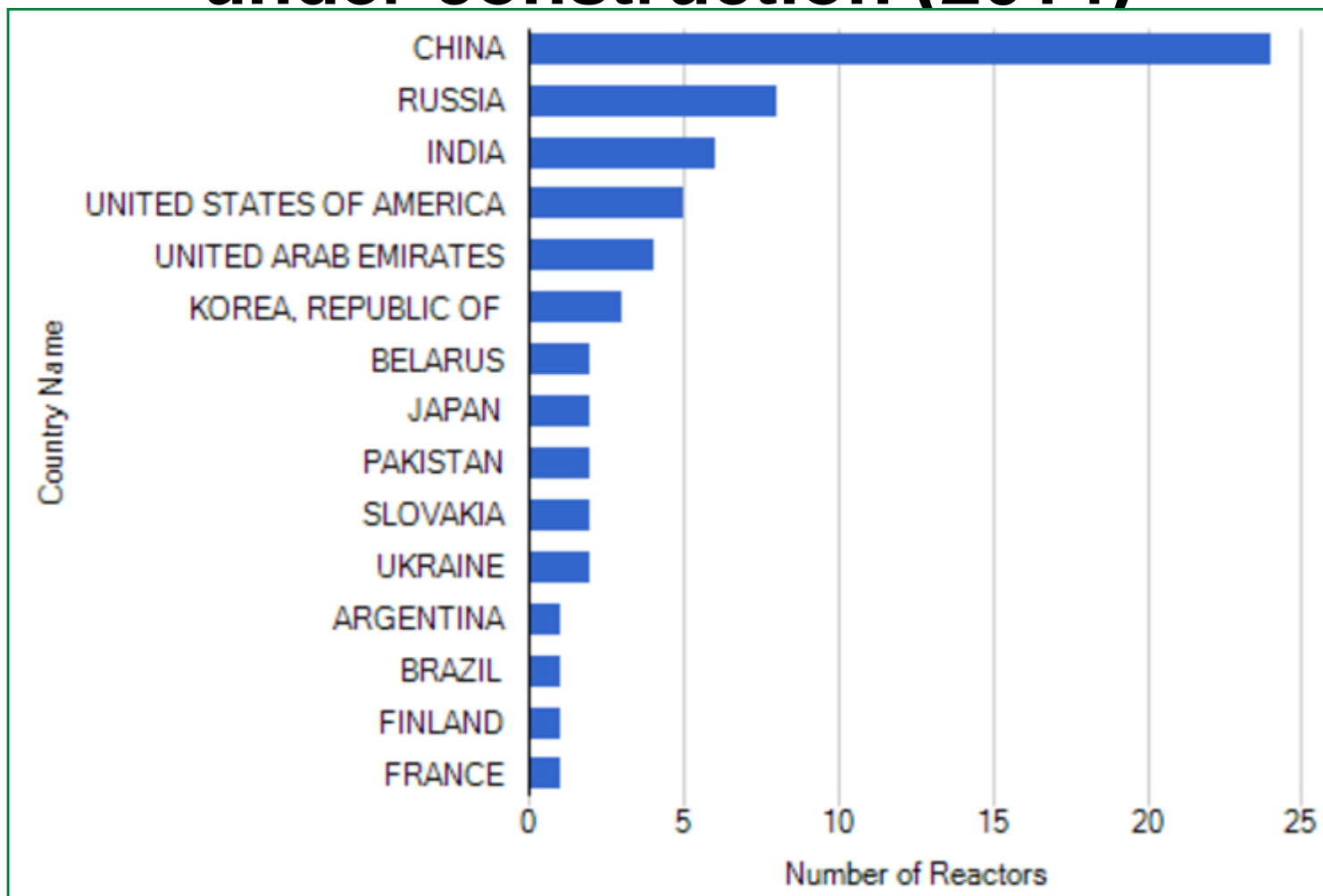
Zaporozhskaya NPP

6 units, 6000 MW

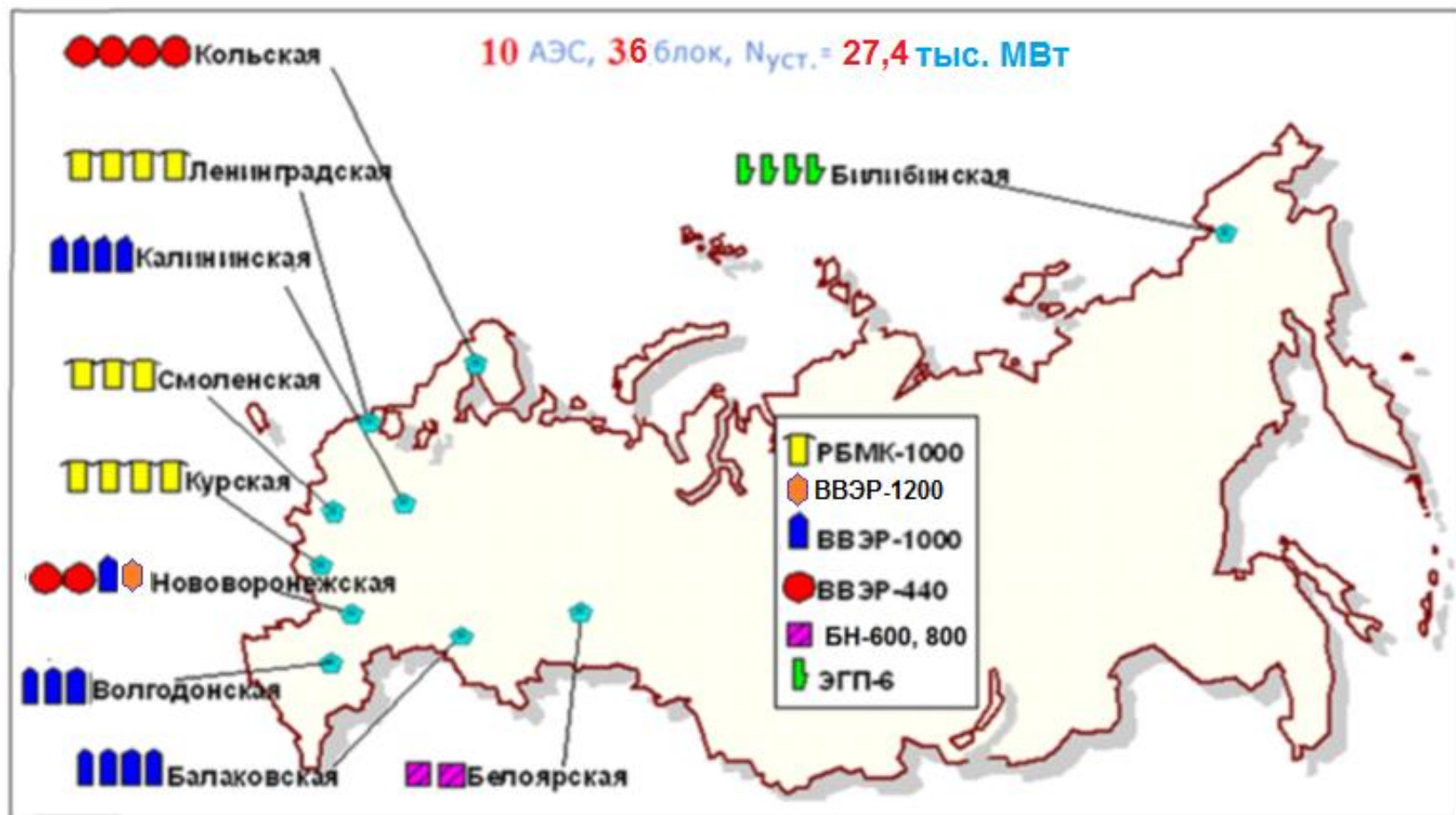
The main trends in the development of the world nuclear energy

1. The displacement of the vector of construction of new nuclear power plants in Asia.
2. Lifetime extension.
3. Improving the competitiveness of nuclear power plants.
4. The formation of positive public opinion.

The NPP's power units under construction (2014)



The current state of nuclear power in Russia



The current state of nuclear power in Russia

- ❑ VVER-440 (pressurized water reactor) 6 units.
- ❑ VVER -1000 12 units.
- ❑ VVER -1200 2 units.
- ❑ RBMK-1000 (uranium-graphite channel type reactor) 11 units.
- ❑ BN-600 (fast-fission nuclear reactor) 1 unit.
- ❑ BN-800 1 unit.
- ❑ EGP-6 (energy graphite reactor with the superheated steam) 4 units.



NPP place in the power of Russia (2019)

Installed capacity share – 11,2%.

Power generation share– 18,6%.

European part of Russia power generation share – 30,5%.

Construction of new Russian NPP units

1. Baltiyskaya NPP. 2 units of VVER-1200.
2. Leningradskaya NPP-2. 2 units of VVER-1200.
3. Nizhegorodskaya NPP. 2 units of VVER-1255 (TOI).
(a typical optimized and informatized)
4. Novovoronezhskaya NPP-2. 1 unit of VVER-1200.
5. Floating NPP «Akademik Lomonosov». 2 units of KLT-40S (pressurized water reactor).
6. Rostovskaya NPP. 1 unit of VVER-1000.
7. Tsentral'naya NPP. 2 units of VVER -1200.
8. Seversk NPP (Seversk, Tomsk region, 1 unit of BREST-300.). (fast neutron reactor)

Thank you for attention!