

National Mineral-raw University “Gorniy”  
Saint-Petersburg, Russia



# **Intelligent Active-adaptive Power System Of Industrial Enterprises**

**Boris N. Abramovich, Professor**

**Veronica B. Prochorova, Chief of department**

**Yuriy A. Sychev, Assistant**

**Denis A. Ustinov, Assosiated professor**

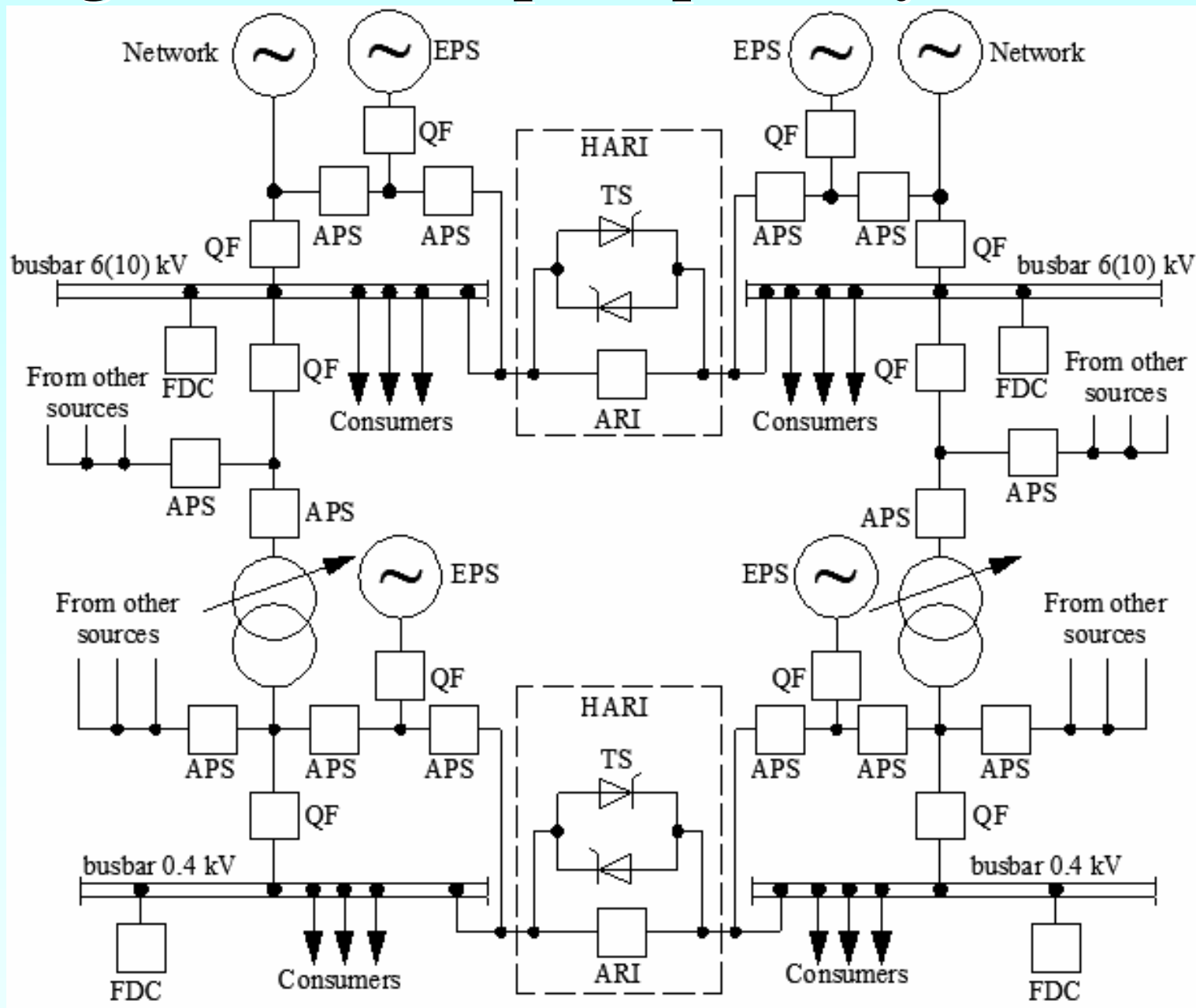
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# Intelligent active-adaptive power system definition

The proposed definition of intelligent active-adaptive power system is following: this is the energy system, which allows by means of modern technologies of monitoring and control to provide active-adaptive changing of structure, power supply and consumption mode, power stream direction for rising energy saving and effectiveness with using of alternative and renewable energy sources



# Intelligent active-adaptive power system structure



# Main elements and principle

The proposed structure includes:

EPS – emergency power supply source;

TS – thyristor switchboard;

APS – automatic point of sectioning;

FDC – filter device of compensation;

SAF – shunt active filter;

HARI – high-speed automatic reserve input;

ARI - automatic reserve input.

These are main elements and devices which form the basic structure of proposed intelligent active-adaptive power system. But the property of intelligence is reached by means of using two main things. First thing is the equipping by control blocks of each element with modern algorithm support. Second thing is the providing of information and control interaction between mentioned control blocks of each elements of proposed intelligent active-adaptive power system. Only these two things together ensure the property of intelligence for proposed active-adaptive power system.



# Main elements and principle

The property of active-adaptive is provided by thyristor switchboard, automatic point of sectioning and high-speed automatic reserve input. These main elements can change the structure of proposed intelligent active-adaptive power system in dependence of power consumption and supply modes. By-turn the power consumption and supply modes of whole intelligent active-adaptive power system are formed by type, rated power, power consumption mode, harmonic spectrum of each load. The influence of power consumption and supply modes on power saving and efficiency level allows to create the methodology of active-adaptive changing structure of intelligent power system accordingly to changes of power consumption and supply modes. That's why the active-adaptive property is very important for proposed intelligent power system.



# Research practice

All mentioned elements of proposed intelligent active-adaptive power system were researched by authors under the leadership of professor Abramovich in different time in power systems of mineral-raw enterprises. The results of these researches allowed creating the methodologies of effective using of these elements. These methodologies are the base of functioning of proposed intelligent active-adaptive power system.



# Research practice

During researches, the structure and parameters of multilevel system of network sectioning by means of perspective devices of remote switching is proved. The basic element here is the automatic point of sectioning or recloser, providing change of network configuration, by switching of various lines depending on damages and emergencies presence, and the thyristor switchboard, intended for power streams control.

During researches, means and methods of electromagnetic compatibility maintenance, power quality control and improvement are developed, including passive, active and hybrid filters, active systems of correction on the basis of shunt active filters, the automated complex control system of power quality and consumption level.

During researches, the qualifier of mineral-raw consumers by criterion of possibility of participation in power consumption control is created.

During researches, the efficiency of reactive power streams control in mineral-raw power systems by means of electromechanical complexes with synchronous engines and thyristor excitation is proved.

During researches, the complex system of relay protection and automatic on the basis of microprocessor devices with free-programmed logic is developed.



# Research practice

During researches, the complex comparative analysis of technical characteristics and functionality of mineral-raw power systems of various structures is made. The result of this analysis allows making the information-operating interaction between elements of intelligent active-adaptive power systems.

During researches, the efficiency of intelligent power system structure control with use of means of high-speed automatic reserve input on the base of thyristor systems.

During researches, the technique of power systems neutral mode choice is developed for increase the efficiency of detecting and eliminating of short circuits.

During researches, the methodology of information-operating interaction between main elements of proposed intelligent active-adaptive power system is developed.

During researches, the technique of power consumption control of mineral-raw consumers in normal and extreme modes is developed.

During researches, the technique of uninterrupted power supply of mineral-raw responsible consumers is developed and proved.





# Research practice

During researches, the organization measures for providing information-operating interaction mode between power system and mineral-raw consumers by optimization of operating modes of the equipment, modes of consumption of active and reactive power and voltage levels is proved and almost realized.

During researches, the structure and technique of key parameters choice of guaranteed power supply system of mineral-raw consumers with use of sources of emergency power supply is developed. The sources of functions on the basis of the alternative renewed energy sources, which allow avoiding occurrence of emergencies and infringement of technological process continuity.

During researches, the functioning algorithm of the control block of power transformer transformation factor is developed for the voltage mode efficient control in mineral-raw power systems. This algorithm is based on the choice of the power line, which defines the voltage mode of whole power system. This algorithm is realized by means of fuzzy logic methods. Formation of the knowledge base on the basis of indistinct rules and expert estimations allows more effectively controlling and analyzing various parameters and factors characterizing the voltage mode of power system.



# Industrial application

Active correction systems of voltage and current form curves on the basis of shunt active filters and complex power quality monitoring systems are introduced on JSC «Orenburgneft» THK-BP.

The high-speed devices of automatic reserve input and the guaranteed power supply systems are developed on JSC «RN-Juganskneftegaz» «NK Rosneft».

The automated power consumption monitoring and account systems and automated power supply control systems are introduced on JSC «Tatneft» and JSC «PO-Kirishinefteorgsintez».

A number of actions for the organization of regime interaction between power system and mineral-row consumers are introduced on JSC «Tatneft»

**Thank You for attention!**