To sum up, the main resources of energy are solid fuels, oil, gas, water, the energy of the uranium core's decay and decay of other radioactive substations.

All main types of power have a negative effect on nature and environment. Thermal power stations pollute the air, slags of stations, which are coal-fired, occupy a huge territory. HPP plain river reservoirs lead to waterlogging. Nuclear power plants are also very dangerous (i.e. the Chernobyl NPP)

The future conception is using unconventional energy resources: the energy of the wind, tides, sun and the internal energy of the Earth.

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OPERATING CONDITIONS FOR CURRENT TRANSFORMERS IN TRANSITION MODES AND THEIR INFLUENCE ON RELAY PROTECTION

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Current transformers play an important role in the power system, because they allow controlling the parameters of the transmitted electricity, and install relay protection and automation devices in power transmission lines.

As in any other device, current transformers have losses. Because of this, not all of the primary current is transformed into a secondary circuit. These losses cause the current error. In addition, the current flowing in the secondary circuit is somewhat shifted to the phase relative to the primary current, which causes the angular error of the current transformer.

Basically, the losses depend on the state of the magnetic circuit of the transformer. While the iron core is not saturated, a directly proportional relationship exists between the primary and secondary currents. If an increase in the primary current, the degree of iron saturation of the magnetic circuit increases and the characteristic be-

gins to deviate from the straight line. At the same time, as the load of the secondary circuit increases, the degree of change in the characteristic increases.

In Figure 1: 1-ideal characteristic, 2-real curve for the nominal load of the secondary circuit Z_{1n}, 3-real curve for a larger load of the secondary circuit $Z_1 > Z_{1nom}$

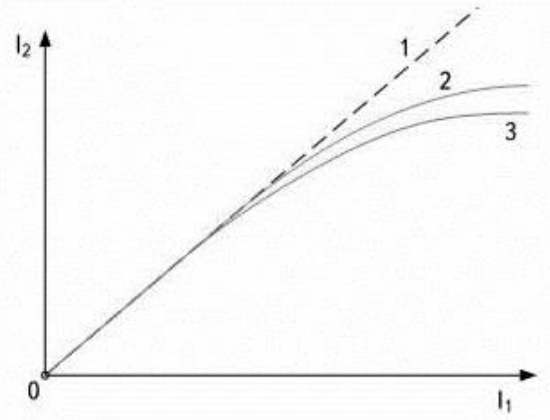

Figure 1. Dependence of the secondary current on the primary in the CTs

Under the transition (dynamic, non-stationary) process or regime in electrical circuits is understood the process of transition of a chain from one steady state (mode) to another. Transient processes occur during any changes in the electrical circuit: when connecting and disconnecting the circuit, when the load changes, when emergency conditions occur (short circuit, wire break, etc.).

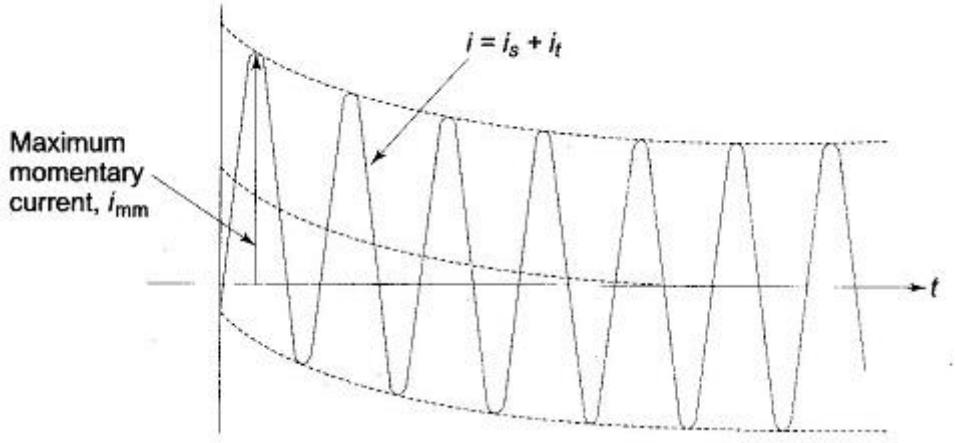

Figure 2. Waveform of a short circuit current on a transmission line

The working conditions of the CTs in protection and automation devices differ significantly from the operating conditions in the measurement schemes. Current transformers intended for measurement have a certain accuracy class and operate in steady state mode with a primary current not exceeding the rated current. In relay protection and automation devices, current transformers must perform their functions at currents significantly higher than rated currents under transient conditions.

A special effect on the operation of the current transformer is provided by the aperiodic component of the primary current appearing in the transient mode. It is transformed into a secondary circuit of the transformer with a greater error, the slower they decay. In other words, as the decay time increases, an increasing proportion of the aperiodic component of the primary current is expended on magnetizing the current transformer magnetic circuit. Features at short circuits near to tires of powerful power stations.

Along with this, the permissible response time of relay protection and automation devices is reduced. Consequently, at the moment of operation of these devices, the aperiodic component of the magnetizing current is many times greater than its periodic component.

All this leads to the fact that the closed steel magnetic cores of current transformers are subject to strong saturation with aperiodic current components and, consequently, to a sharp decrease in their magnetic permeability. This leads to an unacceptable increase in the errors of such current transformers in transient modes. Particularly large errors occur when a residual magnetic flux of the aperiodic component of the magnetizing current is retained in the magnetic circuit of the current transformer.

It should be borne in mind that it is much more difficult to provide the necessary accuracy of the operation of CTs in transient regimes than in established ones. To improve the performance characteristics of CTs in steady-state and transient modes allows the use of new methods for constructing CTs (for example, optoelectronic CTs), and by using the following methods of limiting errors:

- creating paths for the aperiodic component of the primary current in addition to the CT magnetization branch;
- increasing the magnetic permeability of the magnetic circuit in saturation mode;
- elimination or reduction of residual induction in the magnetic circuit;
- Limiting the maximum working induction in the CT magnetic core and reducing the magnetic permeability.

In the transient process, the transformer begins to operate in saturation mode, i.e. When the magnetizing current grows much faster than the working magnetic flux. There are several ways to combat the residual magnetization of the core, as with one of the main causes of saturation.

One of the methods is the use of current transformers with cores without steel having linear properties. But the use of such current transformers can be very limited, due to the low power of the secondary windings. The second method (the most common) is the production of cores made of electrical steel having non-magnetic gaps. This method, in comparison with the use of cores without steel, allows the construction of smaller cores. However, in Russia, current transformers with such cores have not been manufactured and are not manufactured.

DAS SELBSTÄNDIGE HAUS – DAS SONNIGE KRAFTWERK PLUS DER WASSERSTOFF

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In der Schweiz ist das erste selbständige Haus eingesetzt und besiedelt, in dem die energetische Unabhängigkeit mit Hilfe des Wasserstoffes gewährleistet wird. Ist «das Mehrwohnungshaus der Zukunft» von der Fläche 1000 м^2 im Zürichs in Brütten