



OJSC "GIPROGAZCENTER"

**Report for
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THE INTELLIGENT COMPOUND ENERGY SOURCES FOR CONSUMERS OF THE MAIN GAS PIPELINES

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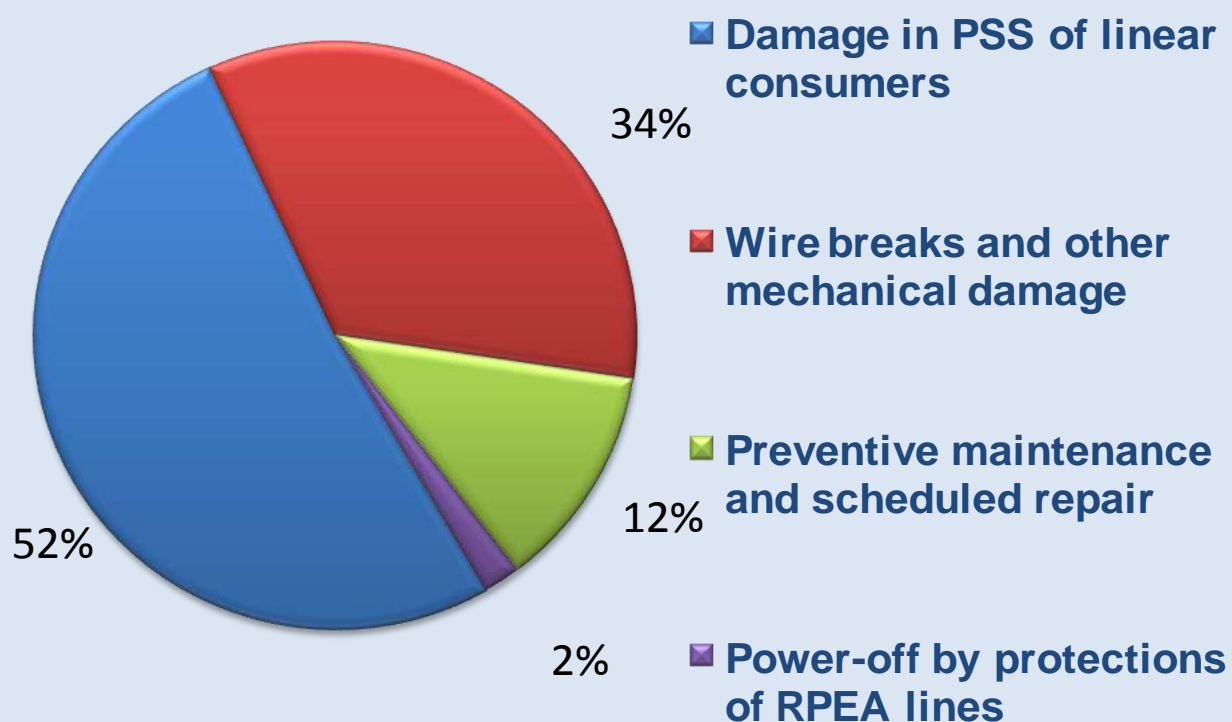
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The analysis of existing power supply systems (PSS) of the main gas pipelines

Features of power supply systems of the main gas pipelines (MG) :

- considerable pipe ranges;
- dispersion of linear consumers along the MG route;
- remoteness from existing external sources and networks;
- low electrical loads of linear consumers (from 2 to 40 kW).

Statistics of damage of MG PSS



1. More than 70% of MG consumers are executed acc. to the III PSS reliability category, not observing STO Gazprom 2-6.2-149-2007.
2. More than 75% of working HV-lines-6 (10) kV and substations are overaged.
3. The absence of reliable RPEA in PSS, ETLs don't have RPEA, including ATS functions.
4. More than 80% of cases of route and feeding ETL refusal are related to unreliability of feeding PSS sources.



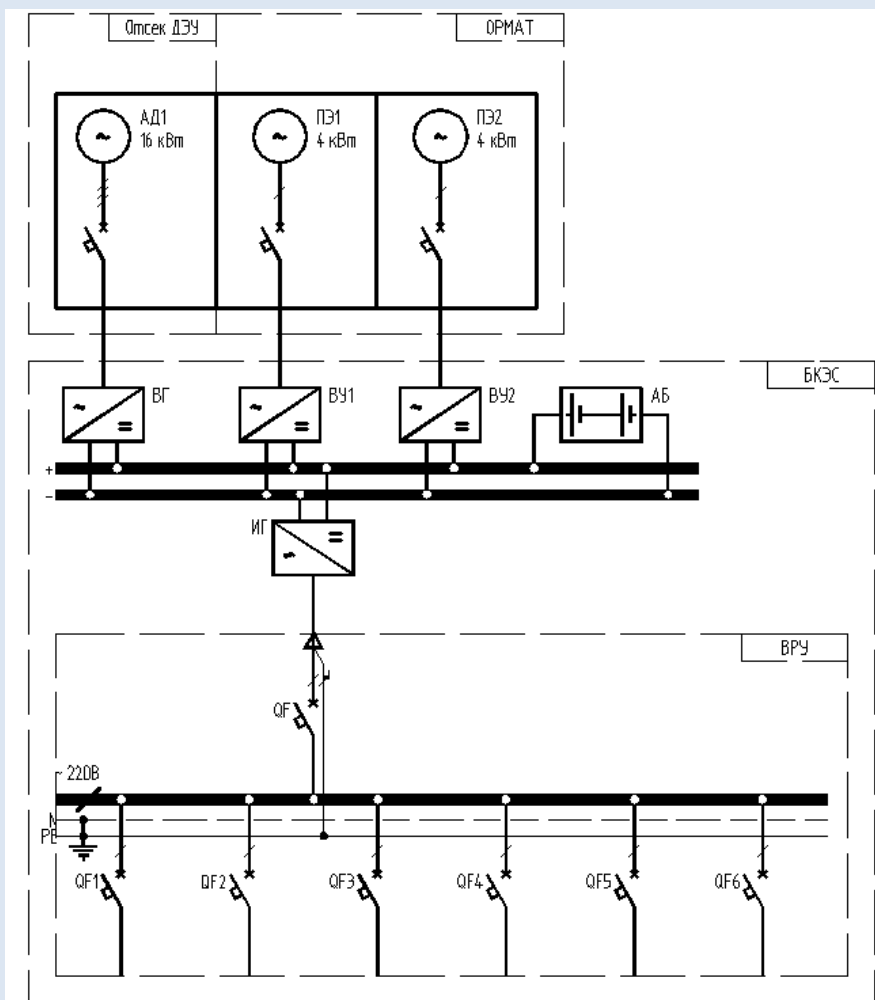
Description of linear consumers and their power supplies

Name of the power supply object	PSS reliability category acc. to STO Gazprom 2-6.2-149-2007	Average power, kW	Normal supply source	Backup power source	Type of SPS-perspective of application
Electrochemical protection units	2	7	HVL-(6) 10kV	HVL-(6)10kV SPS	WDPP, ORMAT, Stirling engine
Telemechanics checkpoint	1	5	HVL-(6)10kV	SPS	The same
Radio relay communication equip.	1	5	HVL-(6)10kV	SPS	The same
Gas-measuring stations	1	20	HVL-(6) 10kV	HVL-(6)10kV SPS	DPU, GSP, MT
Pig launchers	3	2	HVL-(6)10kV SPS		WDPP, ORMAT, Stirling engine
Pig receivers	1	2	HVL-(6) 10kV	HVL-(6)10kV SPS	The same
Gas distribution station	3	40	HVL-(6) 10kV		TEA, DPU, MT
Gas disposition terminals	3	15	HVL-(6) 10kV SPS		DPU,GSP,MT, TEA
Operator's houses	2	3	HVL-(6) 10kV	SPS	WDPP, ORMAT, Stirling engine
Helicopter platforms	3	10	HVL-(6) 10kV		The same

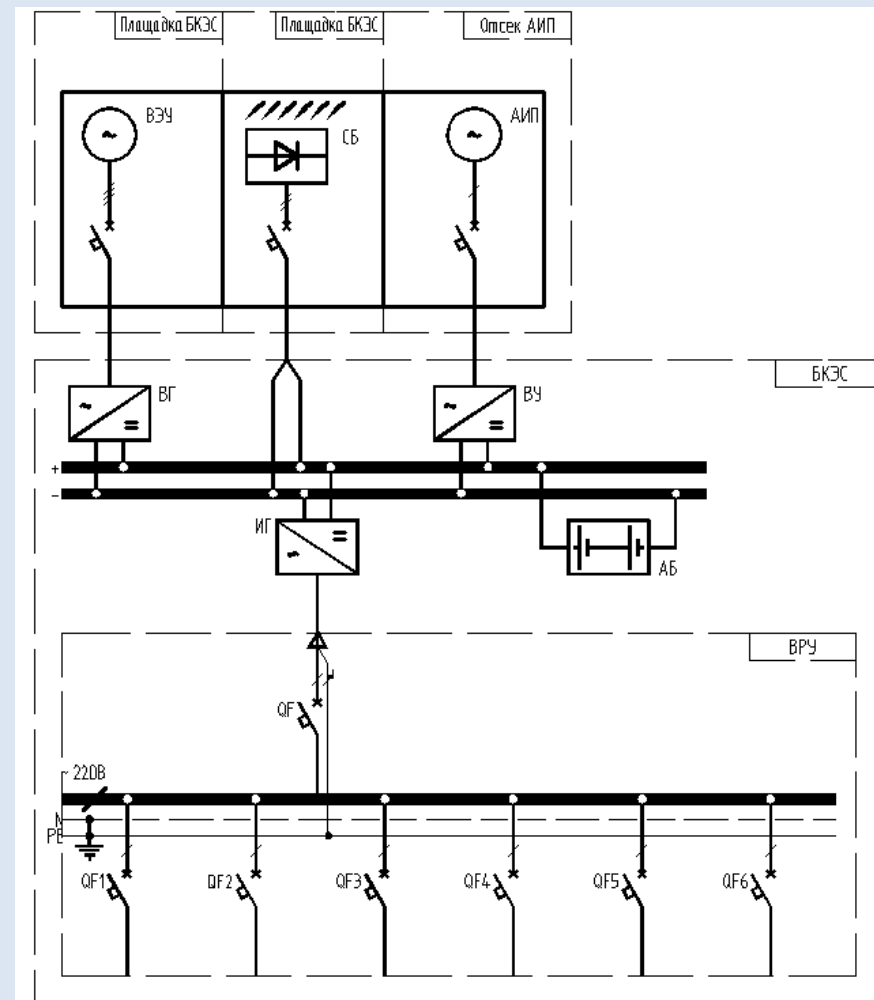
Total capacity of these consumers on the various gas-transport enterprises reaches from 0,25 to 9 MW, and the length of the route ETL makes 150 – 4800 km.



The structure of autonomous PSS of the route MG consumers



Traditional variant

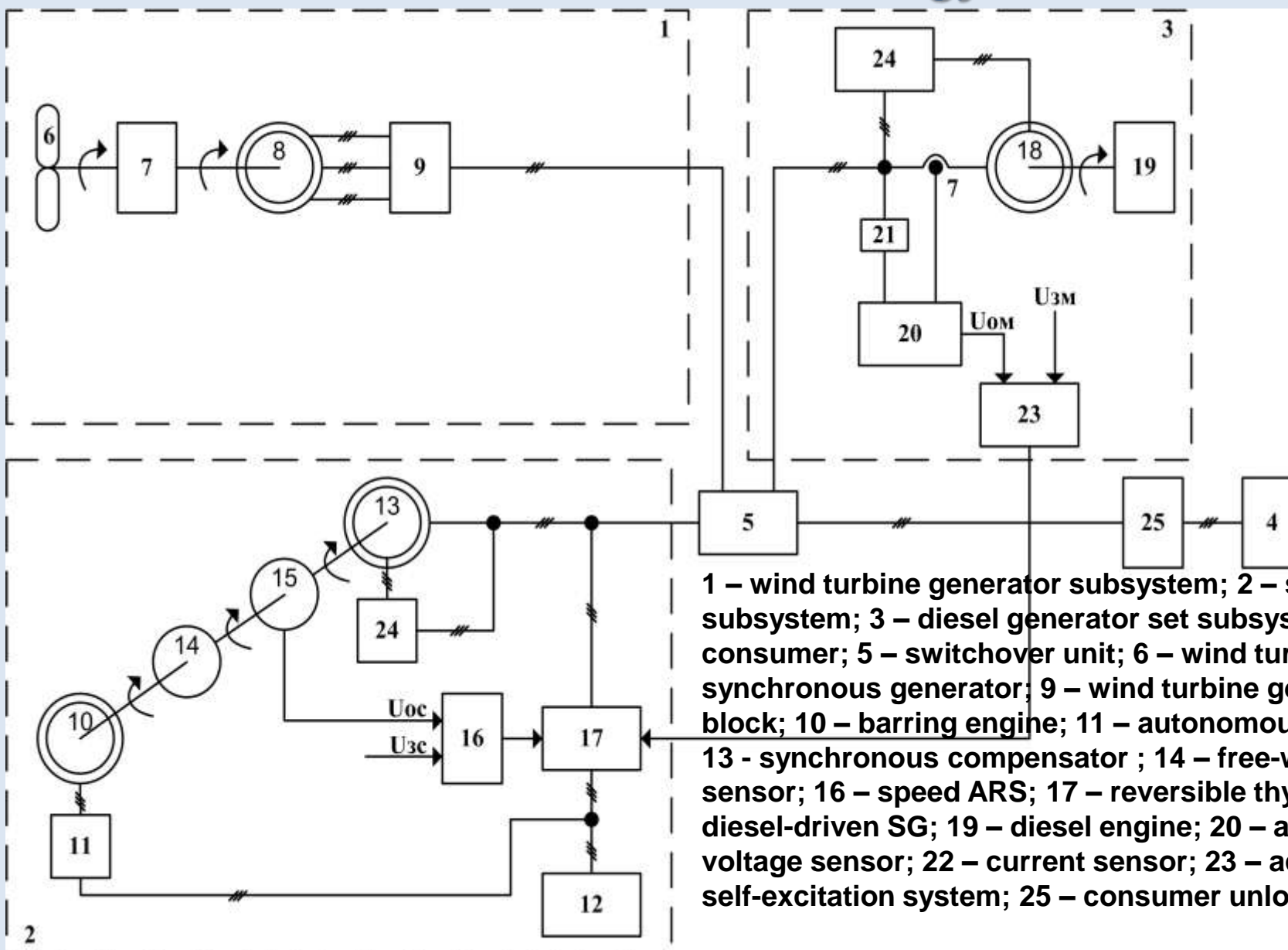


New variant

ВГ- rectifier group; ВУ- rectifier unit; АБ- accumulator battery; ИГ- inverter group; БКЭС – container-type power station; ВЭУ (WDPP) – wind-driven power plant



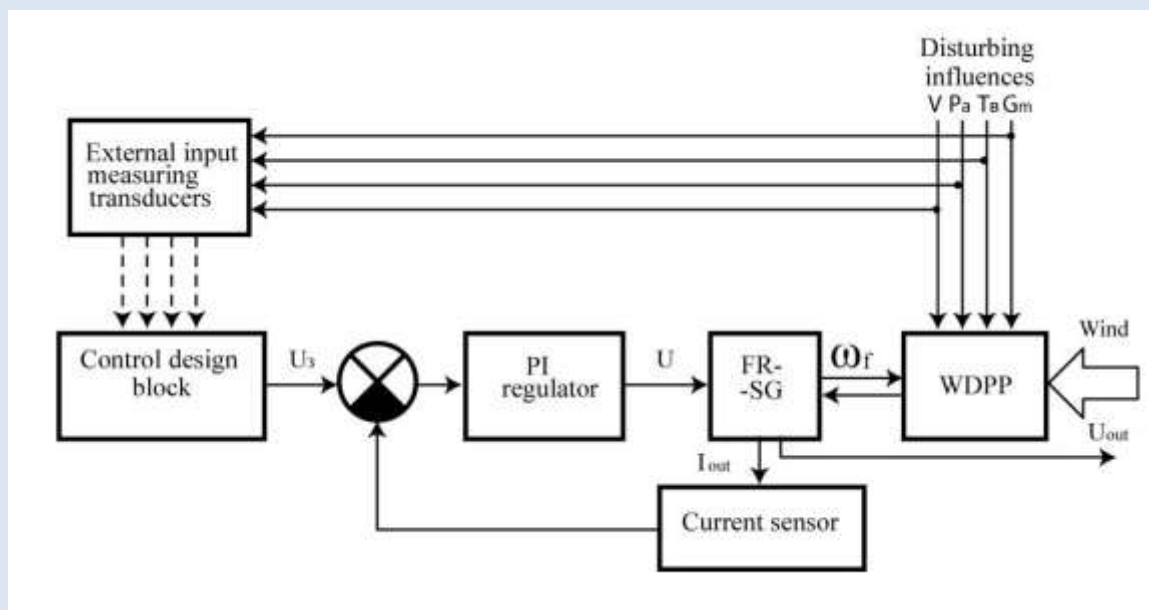
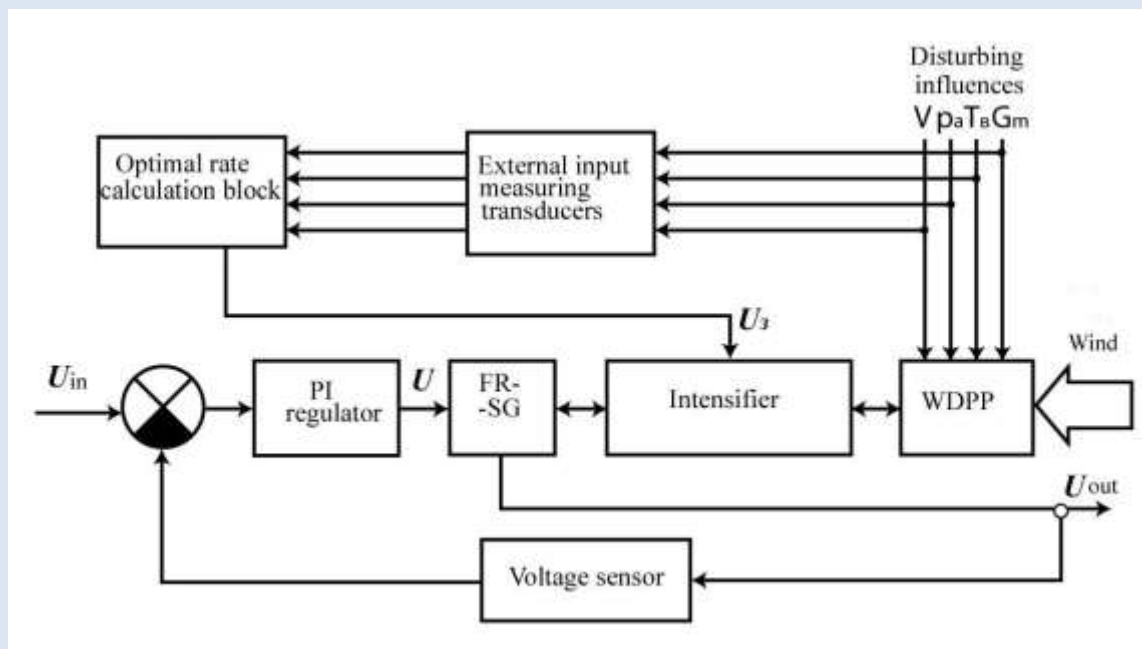
Autonomous system of continuous power supply, using a renewable energy source.



1 – wind turbine generator subsystem; 2 – synchronous compensator subsystem; 3 – diesel generator set subsystem (DGS); 4 – power consumer; 5 – switchover unit; 6 – wind turbine; 7 - intensifier; 8 – synchronous generator; 9 – wind turbine generator mode selection block; 10 – barring engine; 11 – autonomous voltage inverter; 12 - SB; 13 - synchronous compensator ; 14 – free-wheel clutch; 15 – velocity sensor; 16 – speed ARS; 17 – reversible thyristor transducer; 18 – diesel-driven SG; 19 – diesel engine; 20 – active power transducer; 21 – voltage sensor; 22 – current sensor; 23 – active power ARS; 24 – SG self-excitation system; 25 – consumer unloading device.



WDPP invariant models in a standalone mode of generation



Examples of autonomous energy sources practical realization at OAO "Gazprom" MG linear production areas



Traditional ONPS



Autonomous diesel-engine power plant



Micro turbine unit



Block container power plant



WDPP of Briz-5000 type



Summary and recommendations

1. The major factors influencing reliability of PSS work are damage in the central networks and breakages of power lines. For that reason the own alternative generating capacities, which are notable for a short length of air lines (autonomy), reliability, high power efficiency and ecological compatibility (with renewable energy sources) are required for MG.
2. The rational combination of traditional and alternative electric power sources may be implemented only in the combined autonomous generator complexes (AGC) with the integrated ACS of “intelligent” networks on the basis of SMART GRID technologies of several levels.
3. A combined scheme of the “intelligent” PSS is the most preferable for linear MG consumers as it has sufficient reliability and flexibility, ensuring the functioning of all the units irrespective of power gas availability and keeping an optimum length of route ETL. A concept of distributed autonomous generation on SMART GRID principals becomes widespread, and AES have become not only power supplement but also real power compensation of traditional networks of central PSS.
4. Optimization of power removal in real time at local and system levels of PSS ACS within the modernization of CS power utilities allows to achieve high reliability indices, remote monitoring and power efficiency of “intelligent” electrical supply networks for route MG consumers feeding.



THANK YOU FOR ATTENTION !



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