III International Scientific Conference "**Sustainable and efficient use of energy, water and natural resources – SEWAN-2021**"

Title:Application of distributed generation for industrial power supply

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Saint-Petersburg, April 19-24, 2021

The environmental crisis of energy

The main forms of energy impact on the environment are as follows:
Themain amount of energy is still received by humanity through the use of non-renewable resources.

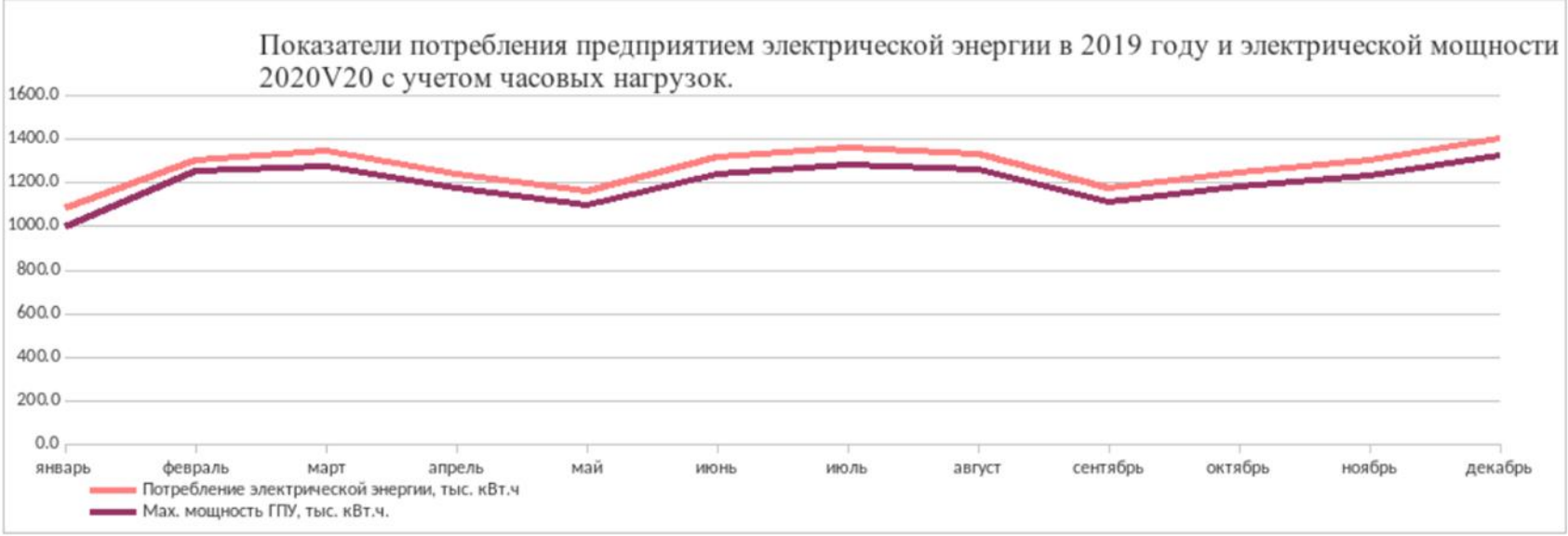
- Atmospheric pollution: thermal effect, release of gases and dust into the atmosphere.
- Hydrosphere pollution: thermal pollution of water bodies, emissions of pollutants.
- Pollution of the lithosphere during the transportation of energy carriers and waste disposal.
- Contamination of the environment with radioactive and toxic waste.Changes in the hydrological regime of rivers by hydroelectric power plants and pollution in the territory of the watercourse.
- Creating electromagnetic fields around power lines.

Green economy concept

For the successful development of the new global "green" course of economic development, it is necessary to:

- Direct significant investments to improve energy efficiency in all areas of activity
- Development of renewable energy sources (RES)
- Creating more fuel-efficient vehicles
- Creating conditions for sustainable agriculture
- Modern water resources management
- Creating closed loops

- The main task is to abandon the centralized power supply and apply the concept of cogeneration.
- Thermal energy is used in production processes.
- The installed capacity of the enterprise is 2.1 MW, the daily load schedule is shown in the figure.



Indicators of the electric energy consumed by the enterprise in 2019 and the electric power of 2020V20, taking into account hourly loads

Plywood factory performance indicators

Параметр	Ед.изм.	2019	2020	2021	2022	2023
Расчет						
			67,12	68,46	69,83	71,22
Основные допущения						
ИПЦ	%		4,2%	3,9%	3,8%	3,6%
Темп роста цен на газ	%		2,9%	3,9%	3,6%	3,3%
Темп роста цен на э/э (РРЭ)	%		2,7%	3,5%	3,5%	3,4%
Темп роста цен на тепло	%		2,9%	3,2%	3,2%	3,6%
Курс валюты	руб./евро	65,80	67,12	68,46	69,83	71,22
Рост цен на обслуживание	%		2,0%	2,0%	2,0%	2,0%
Тарифы и цены						
Потребитель э/э	руб./кВтч	4,96	5,09	5,27	5,45	5,64
Тариф на тепло	руб./Гкал	708,3	728,9	752,2	776,3	804,2
Цена на газ	руб./т.м.3	5351,3	5506,5	5721,2	5927,2	6122,8
Цена на масло	руб./л	150,0	156,3	162,4	168,6	174,6
Средний тариф	руб./кВтч	#ДЕЛ/0!	#ДЕЛ/0!	5,270	5,455	5,640
Производственная программа						
Потребитель э/э	тыс.кВтч		-	15 743	19 394	19 394
Суммарный отпуск	тыс.кВтч	-	-	**15 743**	**19 394**	**19 394**
Затраты э/э на с.н.	тыс.кВтч	-	-	487	600	600
Суммарное производство э/э	тыс.кВтч	-	-	**16 230**	**19 994**	**19 994**
Потребитель т/э	Гкал	-	-	6 125	6 125	6 125
Отпуск тепла	Гкал	-	-	**6 125**	**6 125**	**6 125**
Потребление газа	тыс.м3	-	-	***4 220***	***5 198***	***5 198***
Потребление масла (вкл.замену)	л	-	-	3 246	3 999	3 999

Power supply scheme

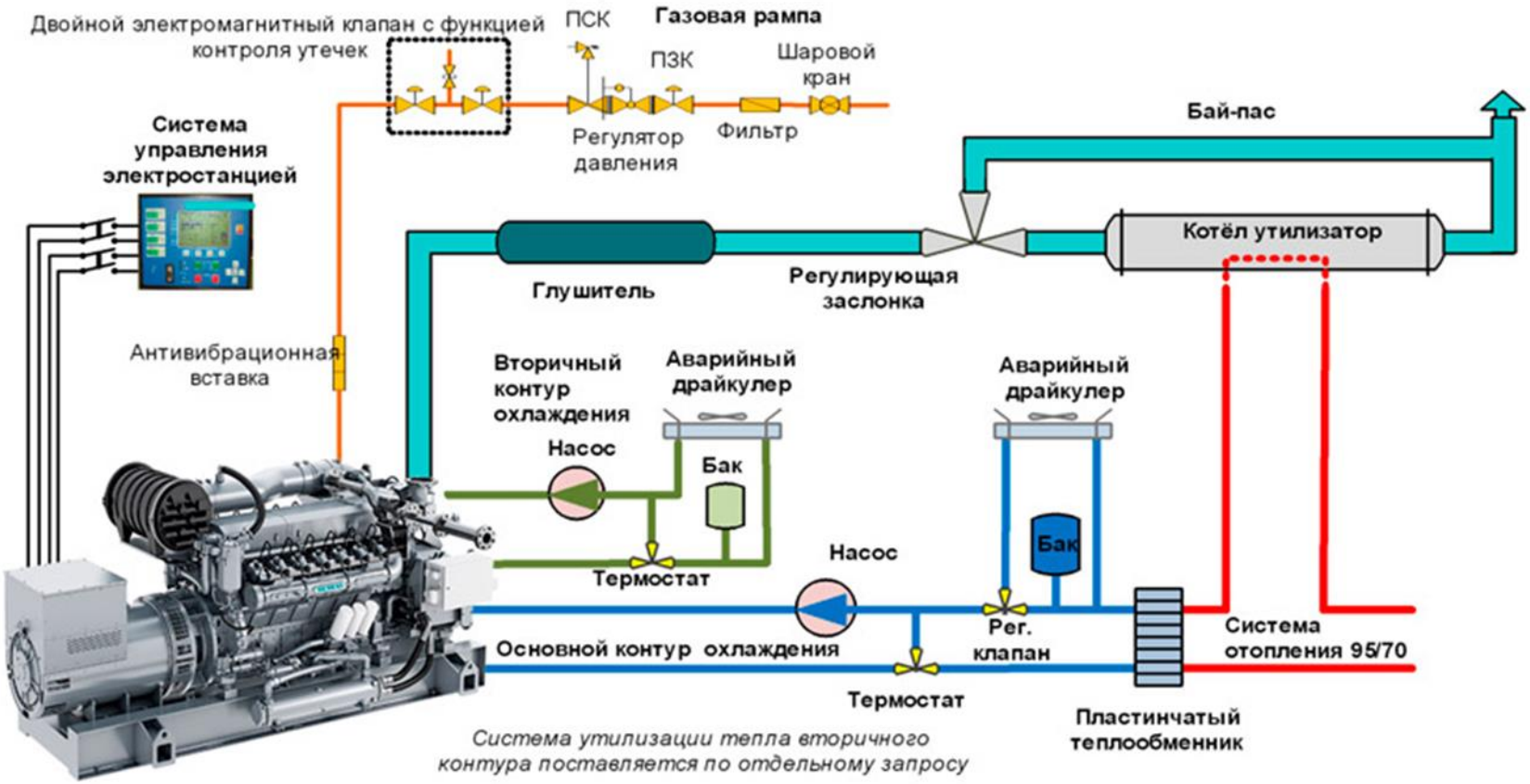
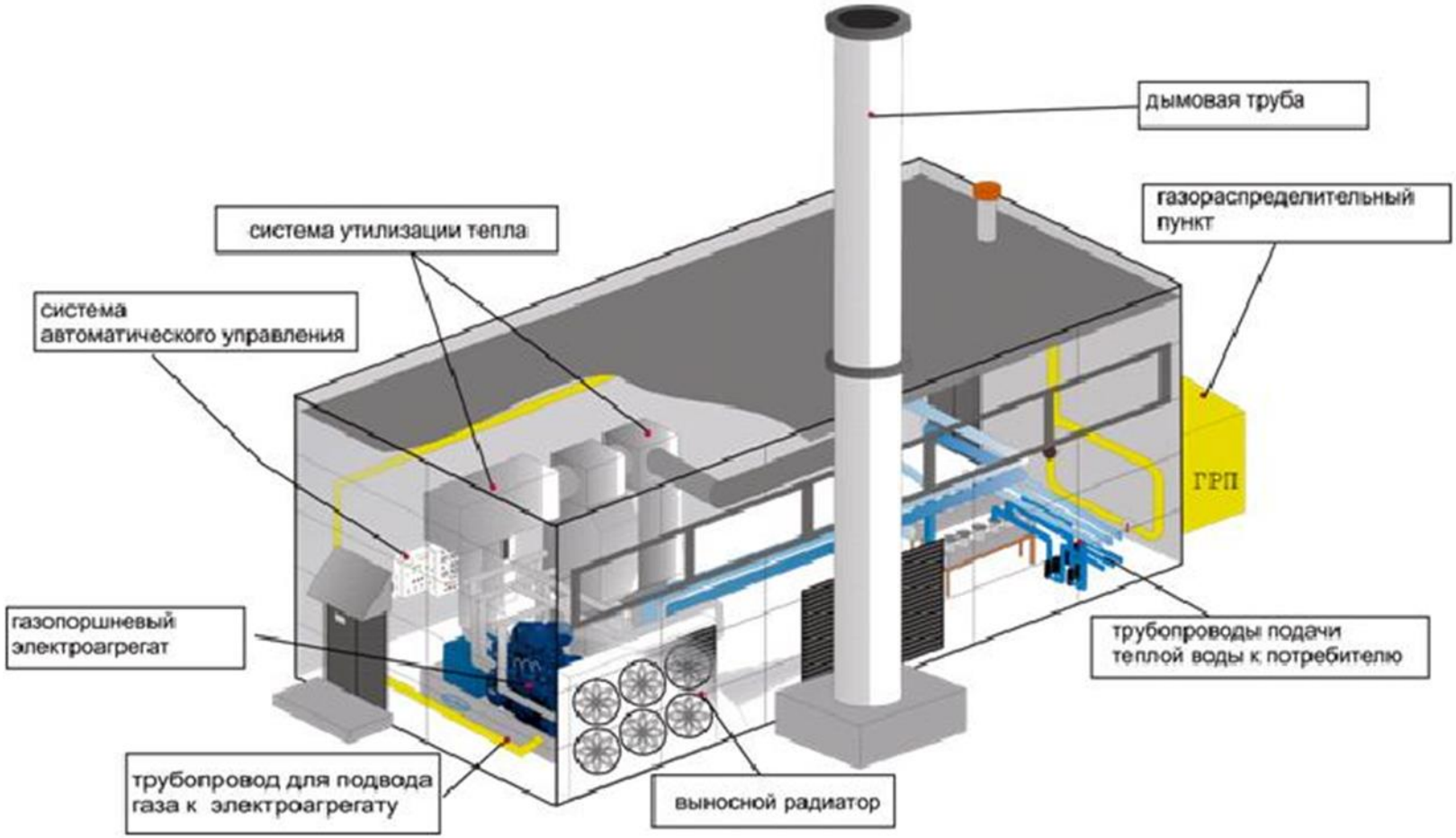


Diagram of a mini thermal power plant

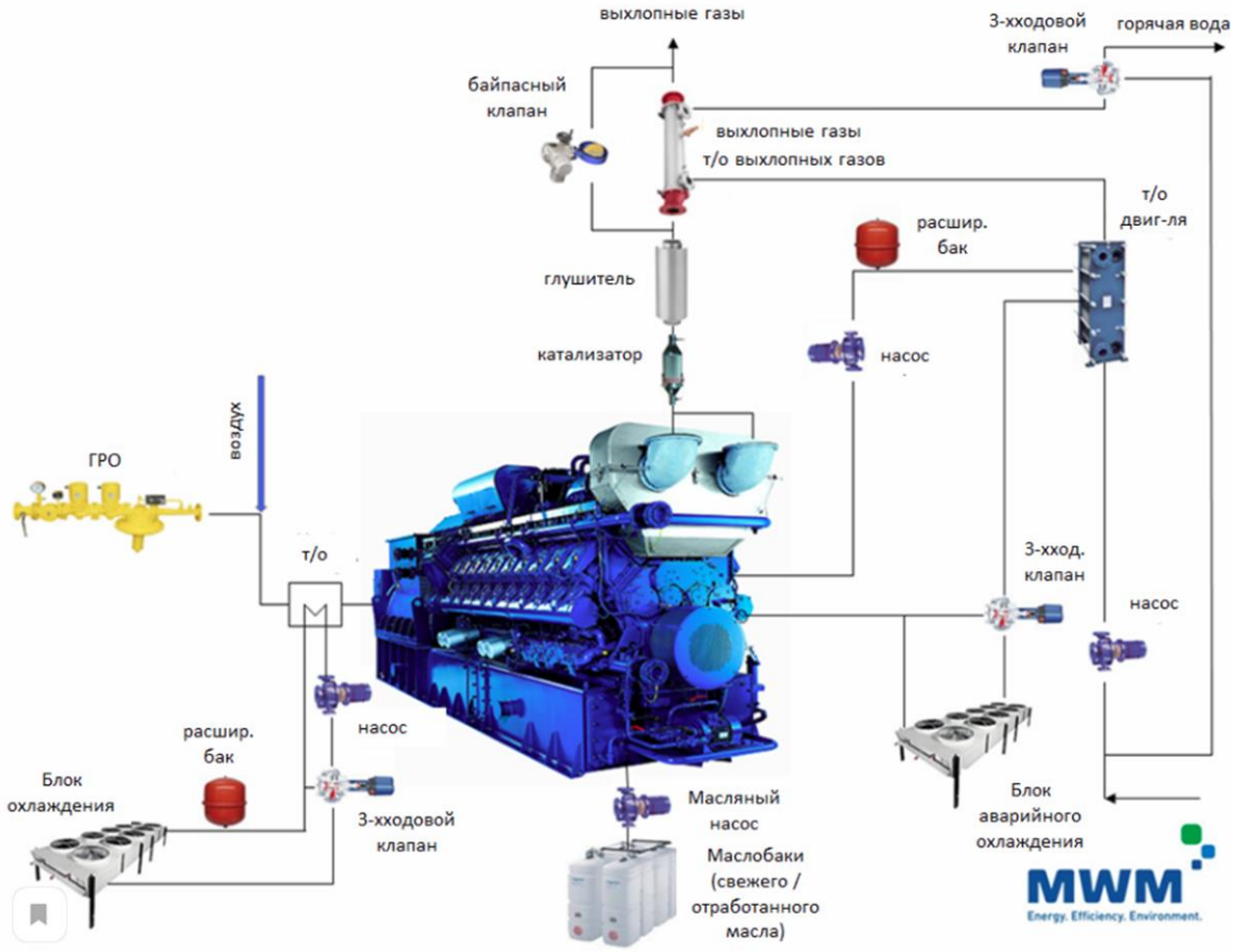


Appearance of the MWM TCG 2020 V20 unit

Characteristics of the MWM TCG 2020 V20 gas piston unit manufactured by MWM GmbH (Germany).

Тип двигателя	TCG 2020 V20
Электрическая мощность (кВт)	2000
Тепловая мощность (кВт)	1985
Скорость вращения (Об/мин)	1500
Напряжение (кВ)	0,4 или 6,3/10,5
Средний расход масла при полной нагрузке (г/кВтч)	0,2
Давление топливного газа (мбар)	20-200
Система пуска	Электростар-терная

Communications



Принципиальная схема устройства установки когенерации

Planned costs for the construction of the project for the needs of a Plywood factory in the Nizhnelomovsky district

№п/п	Наименование работ	Стоимость
1	**Газопоршневая установка**	84 400 000,00р.
	Кап. вложения в ГПУ	81 500 000,00 р.
	Фундамент под ГПУ	700 000,00 р.
	Аренда крана (разгрузка ГПУ и установка на фундамент)	900 000,00 р.
	Заправка техническими жидкостями ГПУ	600 000,00 р.
	Дымовые трубы	700 000,00 р.
2	**РТП с диспетчерской**	9 800 000,00р.
3	**Газоснабжение**	2 500 000,00 р.
4	**Строительномонтажные работы и вспомогательное оборудование.**	3 800 000,00 р.
	Внутриплощадочные кабельные линии (контрольные и силовые)	2 600 000,00 р.
	Линия электропередач до РУ потребителя	1 200 000,00 р.
5	**Пусконаладочные работы по энергоцентру включая лабораторию. Система диспетчеризации по энергокомплексу.**	1 200 000,00 р.
6	**Проектные работы по энергоцентру (генпроектирование) и инженерно геологические изыскания**	1 500 000,00 р.
7	**Получение технических условий от энергоснабжающих организаций**	200 000,00 р.
8	**Благоустройство территории, с учетом возведения подъезных путей**	1 400 000,00 р.
	Итого	**104 800 000,00 р.**

The commissioning of Mini-thermal power plants and the generation of electricity on the territory of the enterprise will allow:

- Toreduce the length of power transmission lines (no more than 200-300 m) and thereby reduce transit losses
- In normal operation, losses in distribution networks amount to 0.63 MWh, or 9 % of the annual volume, with power lines accounting for about half.
- Reducing transit losses by 0.147 MWh will save up to 2 % of the total electricity consumption.
- The reduction in generation volumes will save 450 tons of fuel oil and reduce CO2 emissions by 398.25 tons per year.

CONCLUSIONS

- Quick return on investment – payback period of 4 years.
- Cost-effectiveness. The mini-CHPP generates 1 kWh of electricity and ~1.2 kWh of heat, while consuming an average of 0.3 cubic meters of natural gas per hour.
- Regulation of operating modes according to the need.
- Flexibility, autonomy, fast change of load modes.
- The possibility of purchasing equipment on lease.
- The possibility of installing mini-thermal power plants in containers.
- The possibility of increasing the electric power, by additional installation of energy modules.
- Reduced generation at a local power plant.
- Eco-friendly – reduce CO2 emissions.

Literature

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Thank you for your attention!

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