



Assessment of the pre-war and current state of the Ukrainian energy sector, possible ways of its development in the future
Socio-economic consequences of the transition of the Ukrainian energy sector, possible strategies for achieving carbon neutrality

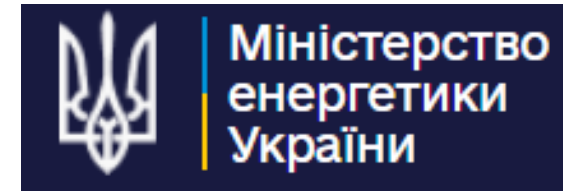
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1. Briefly about the state of the Ukrainian energy industry before the war

Energy potential of Ukraine

No 1 in Europe for reserves of uranium ores

220 th. t.



No 2 in Europe for natural gas reserves

1,1 billion cubic meters
enough for 35 years



No 3 in Europe for coal reserves

34 billion tons
enough for 1000 years



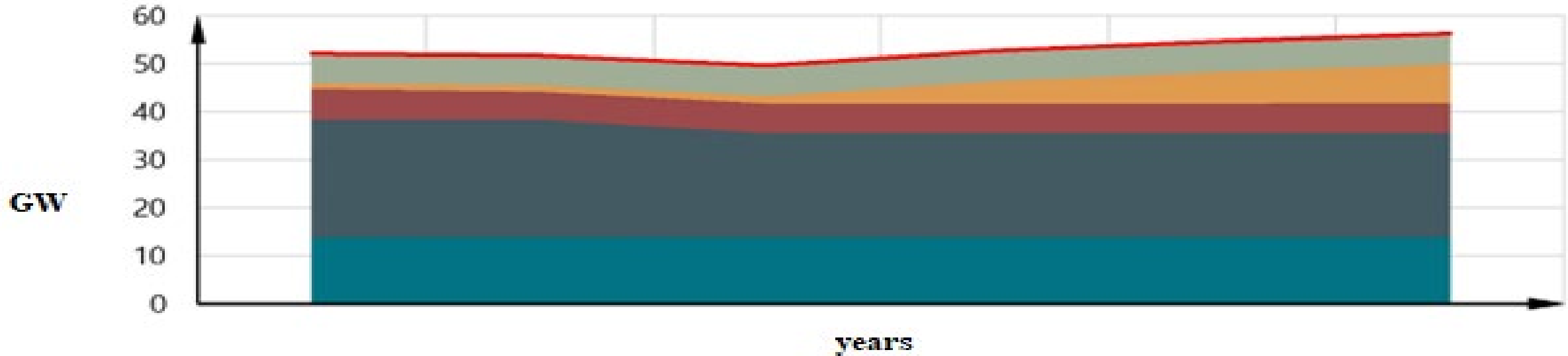
No 39 in Europe for oil and gas condensate reserves

200 million tons
enough for 20 years



1. Briefly about the state of the Ukrainian energy industry before the war

Dynamics of the structure of the installed capacity of power stations of UES of Ukraine *

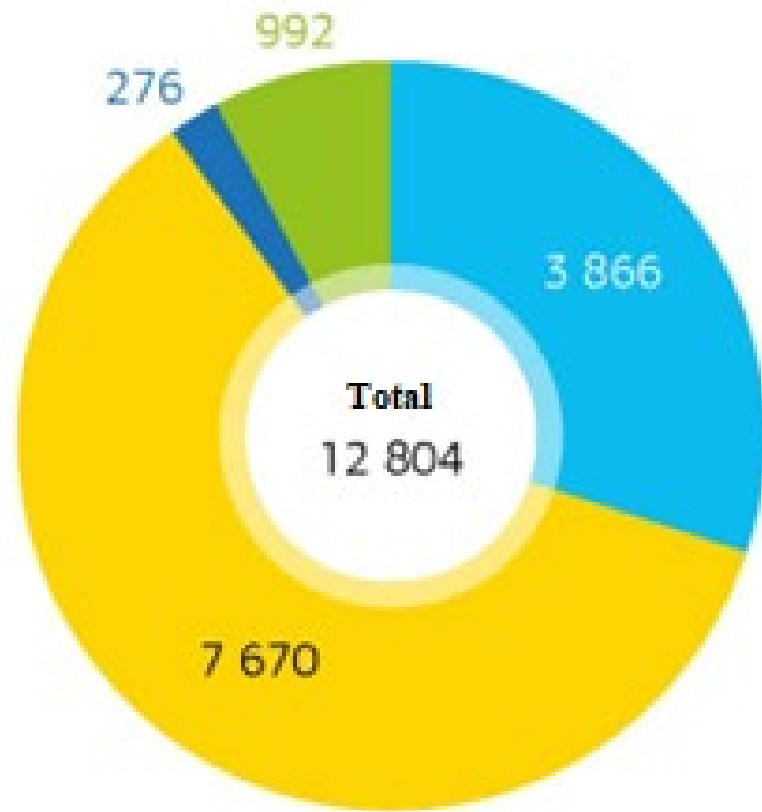


	2016	2017	2018	2019	2020	2021
HPP/HAPP	6.2	6.2	6.2	6.3	6.3	6.3
RES	1	1.2	1.7	4.7	6.7	8.1
TPP	6.5	5.9	6.1	6.1	6.1	6.1
TPP GS	24.6	24.6	21.8	21.8	21.8	21.8
NPP	13.8	13.8	13.8	13.8	13.8	13.8
Total	52.1	51.7	49.6	52.7	54.7	56.2

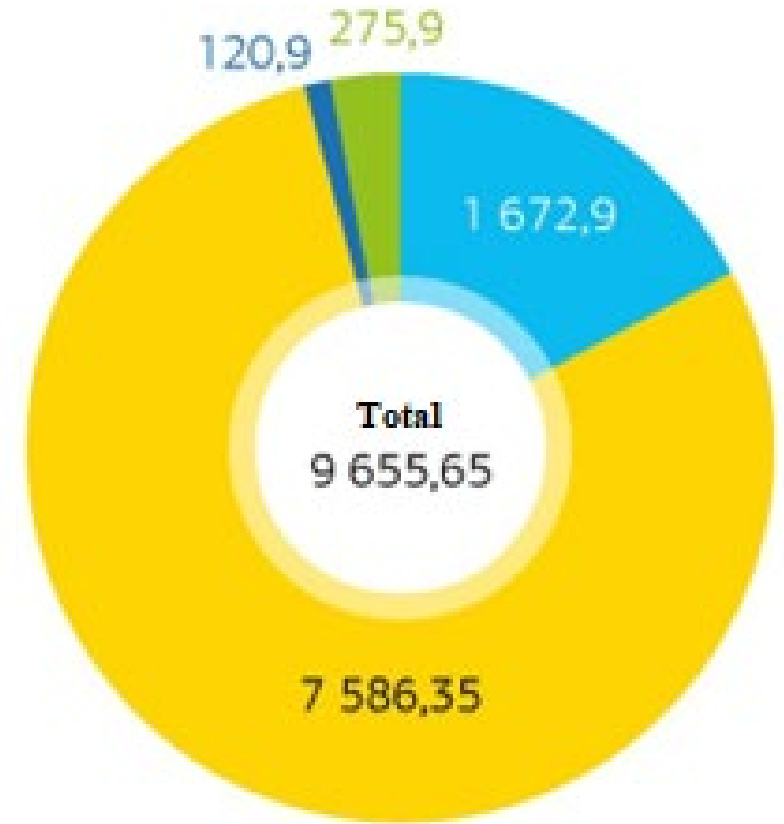
1. Briefly about the state of the Ukrainian energy industry before the war

Electricity production, million kWh

Installed capacity, MW

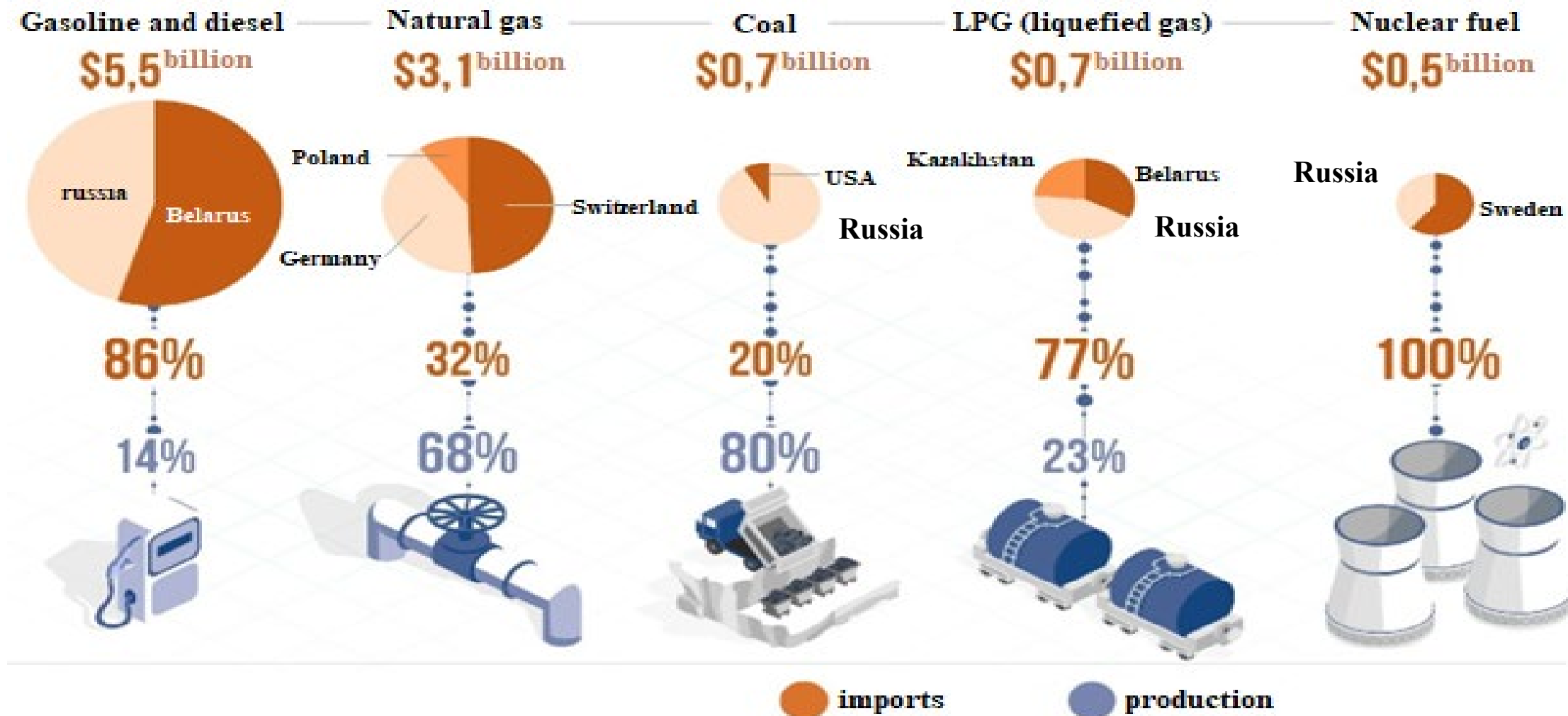


- WES
- SES (including working SES)
- Micro-, mini- and small HPPs
- BioES



1. Briefly about the state of the Ukrainian energy industry before the war

Ukraine's dependence on fuel imports



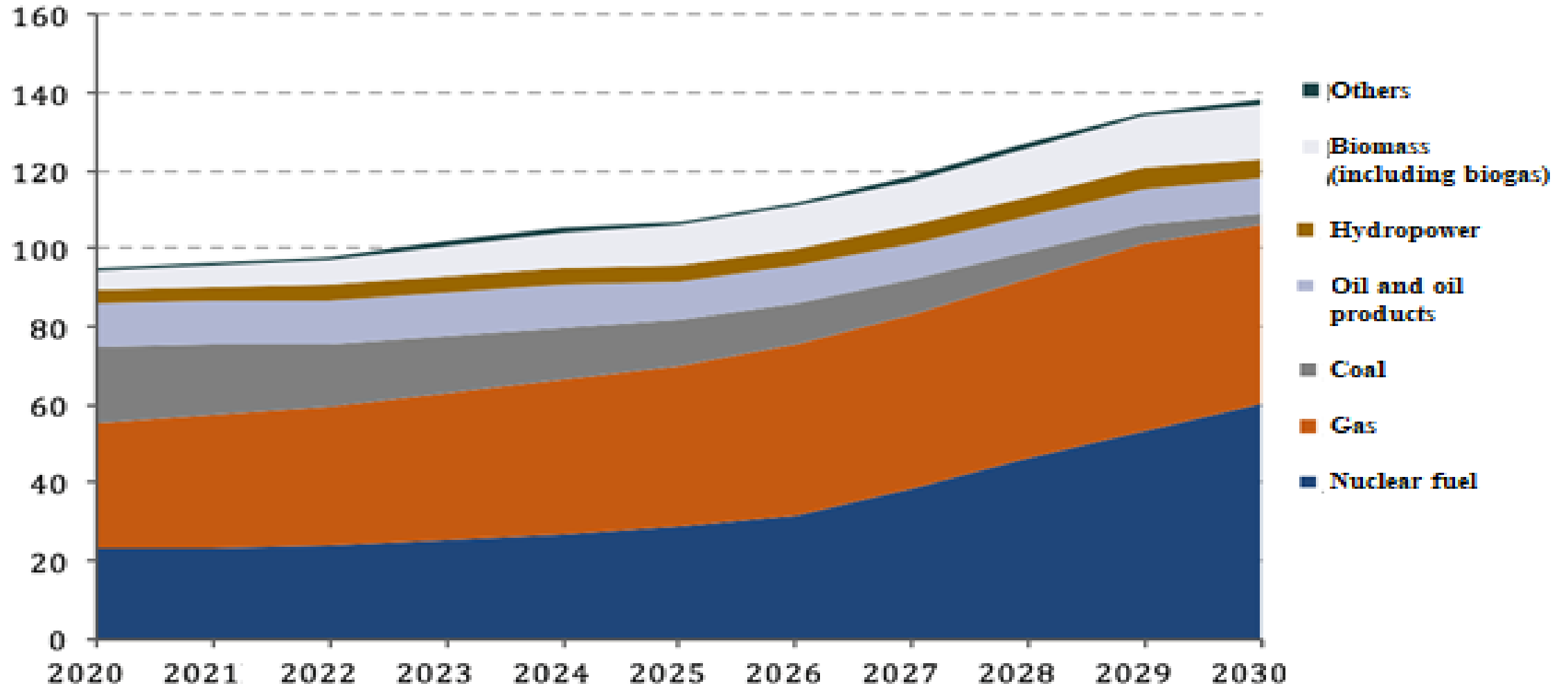
2. Briefly explain what the pre-war plans of the government were for its future development

Forecast of primary supply of energy resources (target scenario)

Indicator	2023	2024	2025	2026	2027	2028	2029	2030
Nuclear fuel, o. e.	474	498	543	593	733	872	1 012	1 141
own production		125	272	445	733	872	1 012	1 141
imports	474	374	272	148	-	-	-	-
Gas, billion m3	41,1	42,9	44,0	47,4	47,8	49,7	51,7	49,5
production	35,0	41,0	48,0	56,1	65,4	75,6	87,0	99,5
imports	6,1	1,9	-	-	-	-	-	-
export			4,0	8,7	17,6	25,9	35,3	50,0
Coal, million tons	28,1	26,0	23,5	20,7	17,5	13,9	9,9	5,6
production	27,9	28,2	27,9	27,8	27,6	27,7	28,0	28,1
imports	0,2	-	-	-	-	-	-	-
export		2,2	4,4	7,1	10,1	13,8	18,1	22,5
Oil, million tons	5,8	7,3	9,0	9,0	9,0	9,0	9,0	9,0
production	5,8	7,3	9,0	9,0	9,0	9,0	9,0	9,0
imports	-	-	-	-	-	-	-	-
Hydropower, million o. e.	4,1	4,4	4,5	4,6	4,7	4,8	5,0	5,1
Biomass, million o. e.	8,0	9,2	10,0	10,7	11,3	12,4	13,3	14,0
Other VER, million t o. e.	1,0	1,0	1,0	1,1	1,1	1,2	1,2	1,2

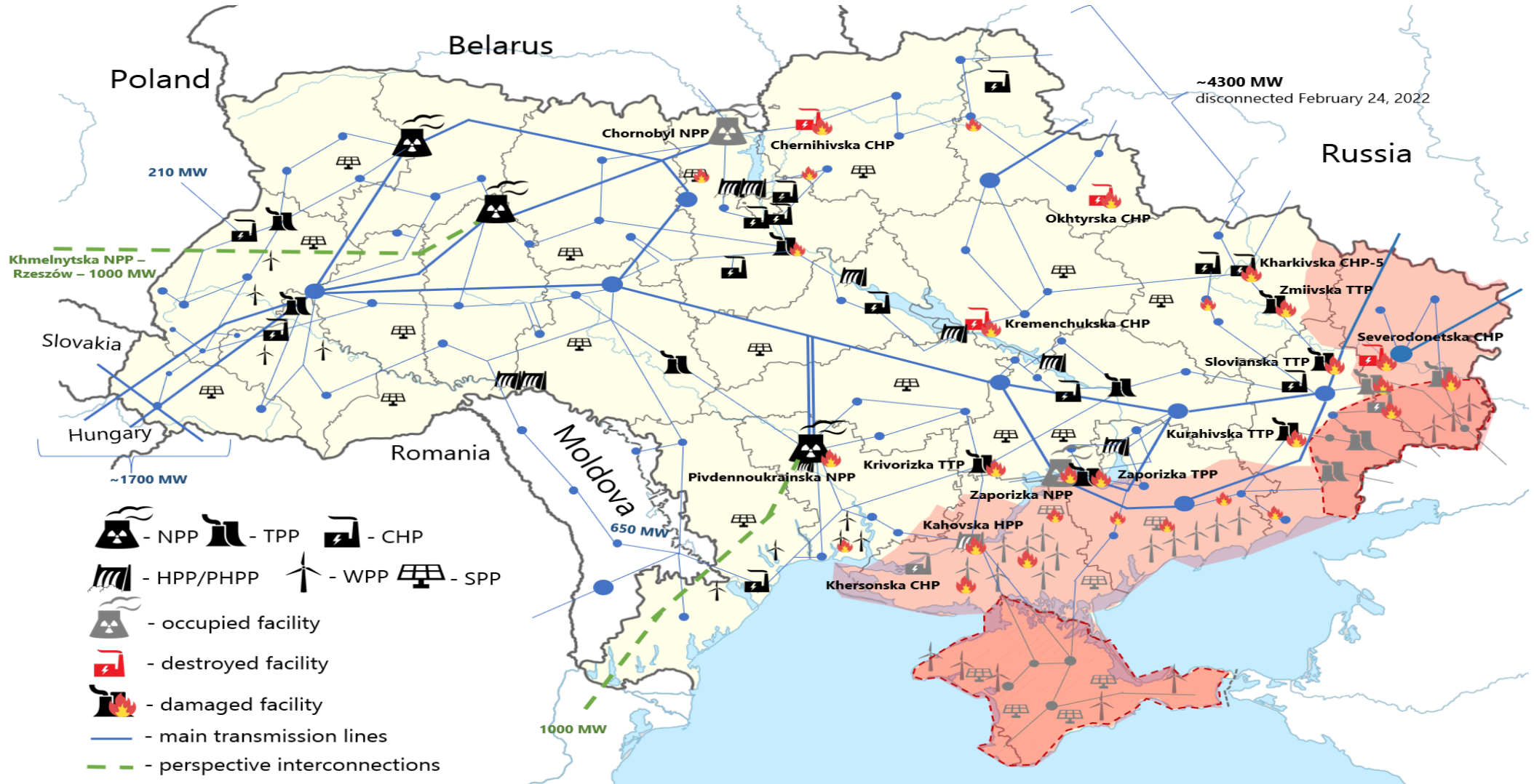
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Primary supply of energy resources in Ukraine, million t.o.e. (target script)



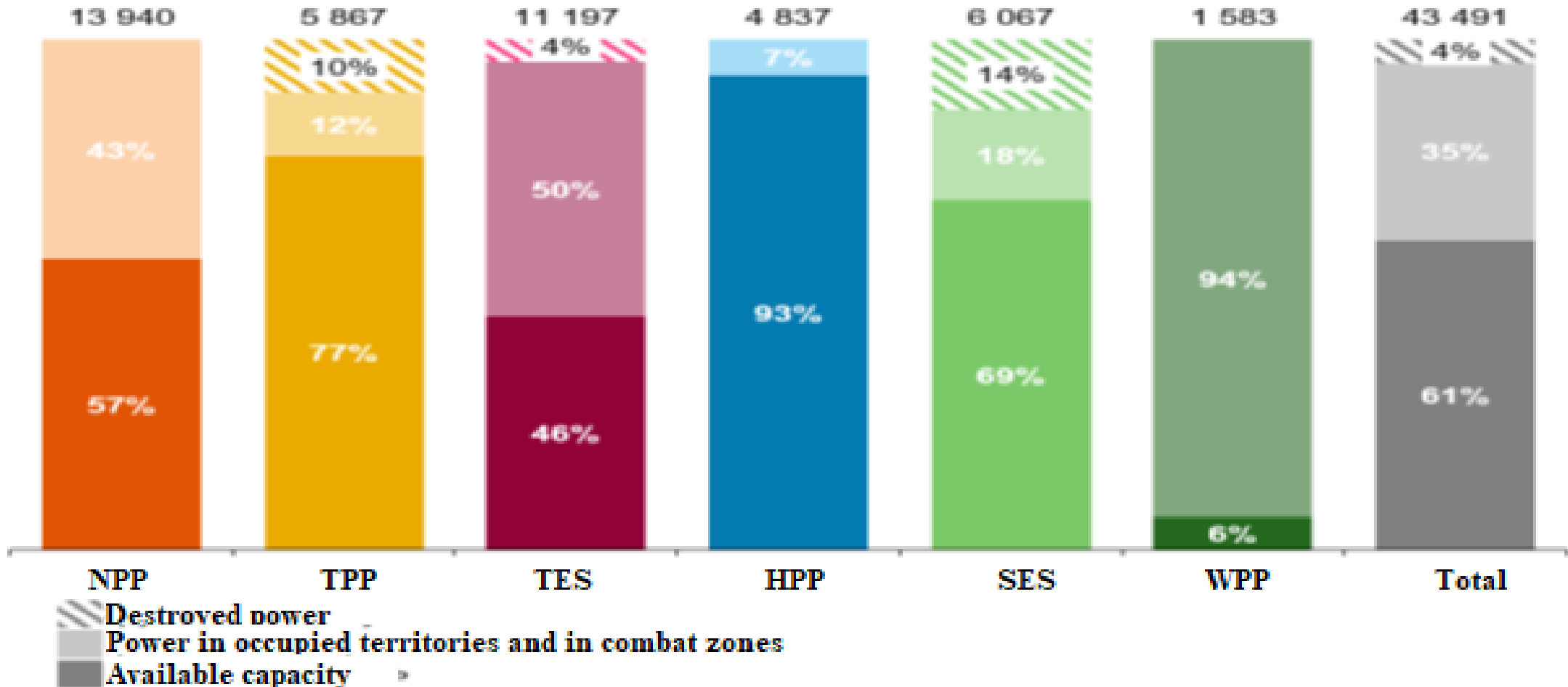
3. Briefly about the damage to the sector caused by the war

Map of regions not controlled by Ukraine



3. Briefly about the damage to the sector caused by the war

The distribution of the operating capacity of the elector generation of Ukraine during the Russian invasion



4. Restoring the old energy system of Ukraine does not make sense. Ukraine must rebuild its energy sector for the needs of a green economy. What can this future energy sector do.

Basic assumptions of energy security of Ukraine

- **European integration is a strategic priority for the development of Ukraine and the Ukrainian energy industry**
- **Restoration and modernization of the energy industry will require significant financial resources, and Ukraine will create favorable conditions for attracting investments**
- **Ukrainian consumers need to be provided with reliable access to energy resources, and vulnerable consumers need to be protected from energy poverty.**
- **Ukrainian energy industry should ensure the rapid recovery and development of the existing economy and the formation of a new economy**
- **Ukraine refuses to import any energy carriers and components from the Russian Federation and seeks to increase the use of domestic resources.**

4. Restoring the old energy system of Ukraine does not make sense. Ukraine must rebuild its energy sector for the needs of a green economy. What can this future energy sector do.

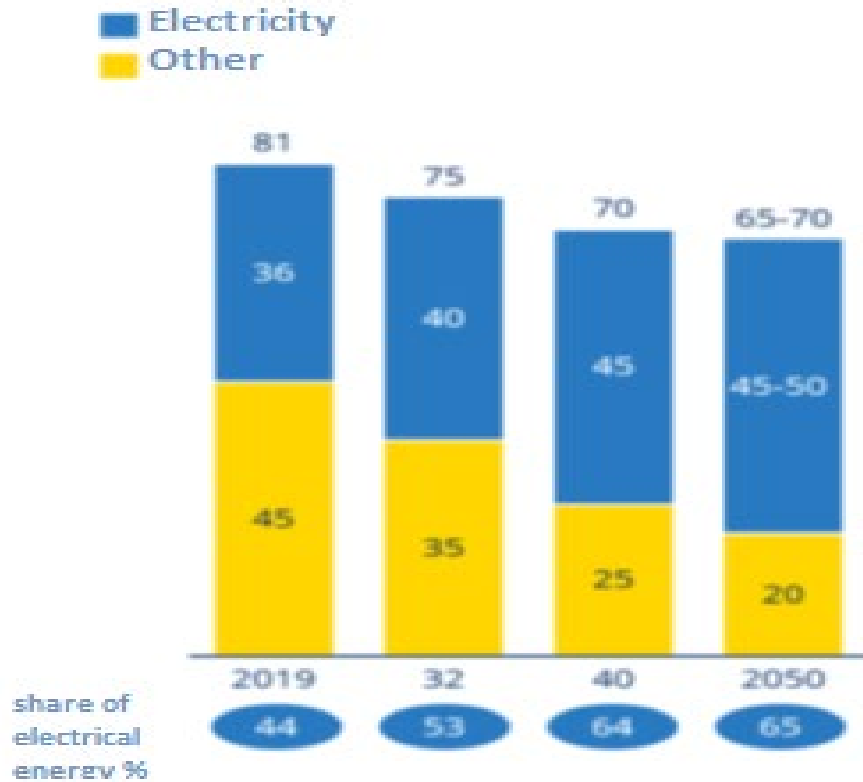
Accordingly, the new Energy Strategy of Ukraine has the following initiatives:

- **acceleration of European integration of Ukraine and fulfillment of requirements for a candidate country for EU membership.**
- **meet the requirements of the European Green Course, contribute to the fulfillment of Ukraine's international obligations in the field of energy, increase the share of carbon-neutral energy resources in the energy balance.**
- **contribute to reducing the need for energy resources, do not require non-market approaches to pricing and contribute to reducing the need for budget expenditures to support vulnerable consumers.**
- **be commercially attractive, contribute to investment attraction, export of goods and services, and increase in revenues to the state budget**
- **allow to reduce dependence on imports.**
- **the priority direction is the improvement of power system balancing capabilities (due to the opening of new highly maneuverable capacities, energy storage systems, electricity export to the EU market, demand management measures and stimulation of balancing on the part of consumers), which paves the way for increasing RES production;**
- **from the point of view of energy security, it is expedient to shift the demand from petroleum products in transport to gas and electricity, as well as in heating from gas to electricity, which requires, in particular, a corresponding renewal of networks;**
- **it is advisable to reduce the need for scarce types of energy resources by increasing energy efficiency;**
- **maximum priority is given to the market solution of energy security issues (creation of fuel stocks, reserve capacities);**
- **the choice between alternative market solutions and/or the share of each solution is determined on the basis of economic feasibility and speed of implementation.**

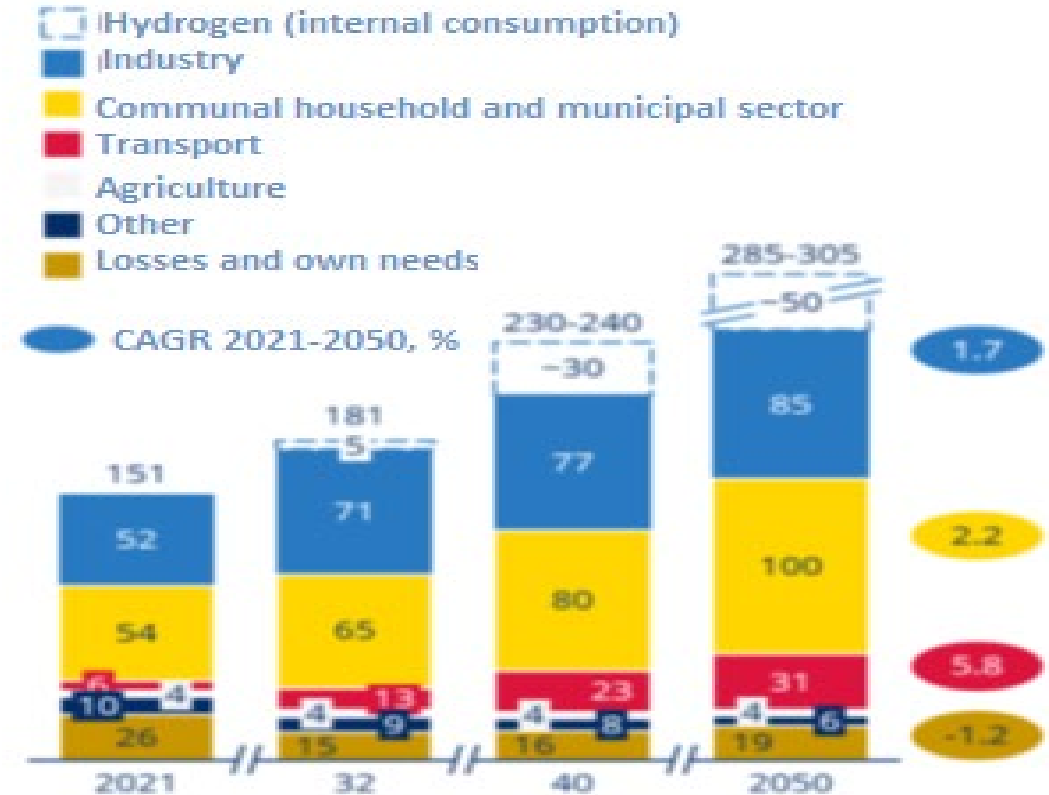
4. Restoring the old energy system of Ukraine does not make sense. Ukraine must rebuild its energy sector for the needs of a green economy. What can this future energy sector do.

Possible energy balance and internal consumption of electricity until 2050*

Energy balance, 2019-2050, million tons. oil equivalent



Domestic gross electricity consumption, 2021-2050, TWh.



* Export of produced hydrogen is expected at the level of 1.5+ MT by 2032

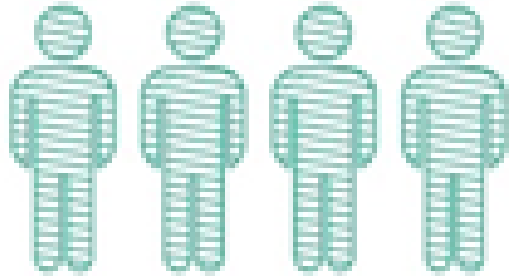
5. Such a transformation will lead to systemic changes that will affect thousands of people currently working in traditional industries, especially in the coal industry

Humanitarian consequences of war, depending on the region

	% of respondents						
	Ukraine	West	Center	Kyiv	North	South	East
Decrease in regular income	33	26	30	36	44	31	37
Total loss of income	13	6	6	13	18	19	22
Job loss	19	8	10	22	32	24	31
Depression, stress, fear	3	2	3	3	3	5	1
Failure to provide proper medical care	7	4	4	5	11	10	8
Famine	2	1	0	2	3	4	3
Loss, destruction of a house or property	9	1	3	5	17	5	33
Separation of the family	22	11	17	28	20	28	39
Loss of life or health	6	5	4	2	10	6	8
Illegal mobilization	1	0	1	0	1	1	4
None of that	27	45	37	24	14	16	9
 The indicator is lower than in Ukraine in general The indicator is higher than in Ukraine in general)							

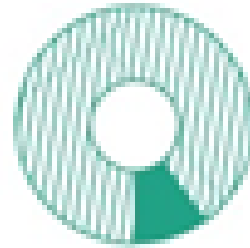
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Evaluation of the employment of miners after the liquidation of mines



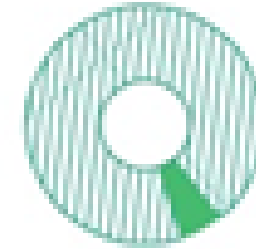
up to 10,000 people

total number of employees

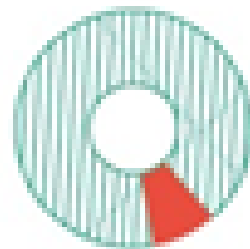


≤ 1000
early retirement

number
of people

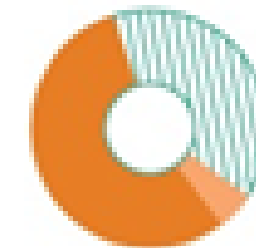


500-600
will become unemployed



≈ 900
register as unemployed

number
of people

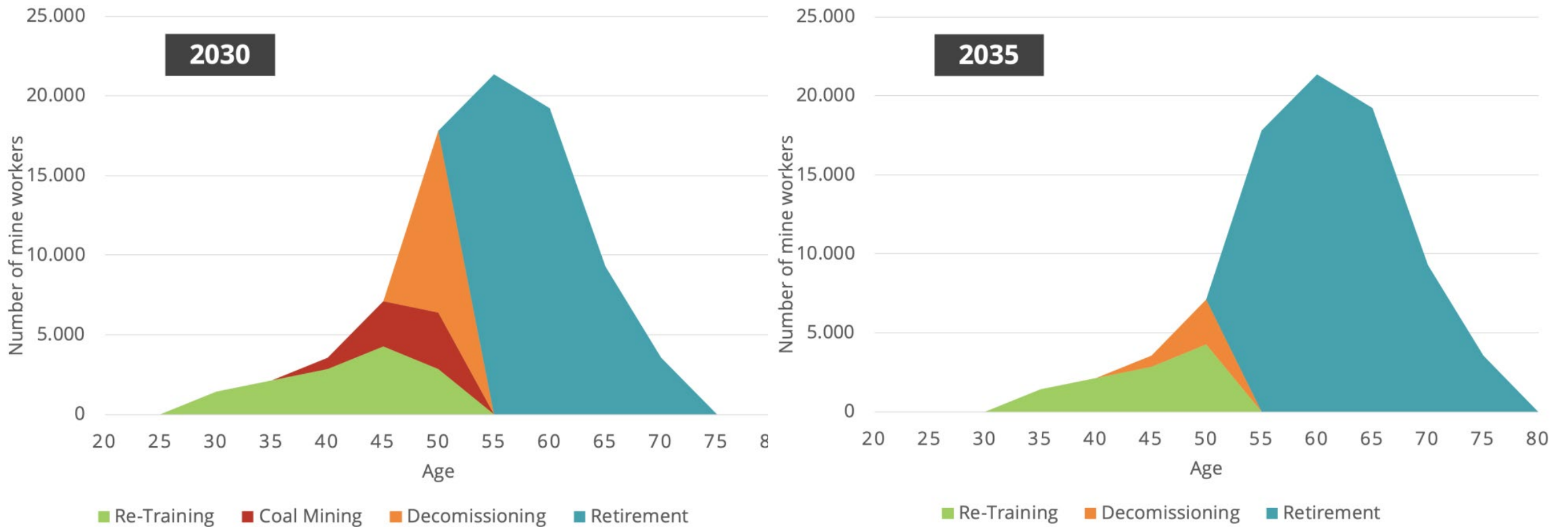


≈ 6000
will need
a new job

400-500
will be able to open
their own business

5. Such a transformation will lead to systemic changes that will affect thousands of people currently working in traditional industries, especially in the coal industry

Slow cessation of coal mining in Ukraine. Most of today's state mine workers will retire in 2030, and by 2035 there will be none left in the mines.



5. Such a transformation will lead to systemic changes that will affect thousands of people currently working in traditional industries, especially in the coal industry

Poverty level by region of Ukraine for 2020-2021, %*

	Relative criterion by expenses		The absolute criterion for incomes below the actual subsistence minimum	
	2020	2021	2020	2021
Ukraine	25,4	24,8	28,3	23,7
Volynsk	26,9	25,3	31,3	19,2
Dnipropetrovsk	18,0	19,3	23,6	20,4
Donetsk	28,5	25,0	30,9	18,8
Luhansk	35,1	25,6	28,3	24,5
Lviv	17,3	30,0	30,2	22,7

*not including part of the anti-terrorist operation zone.

5. Such a transformation will lead to systemic changes that will affect thousands of people currently working in traditional industries, especially in the coal industry

Coal mines in Ukraine, in particular in Donbas, are among the most dangerous in the world (for every million tons of mined coal, 2.5 lives of miners die):

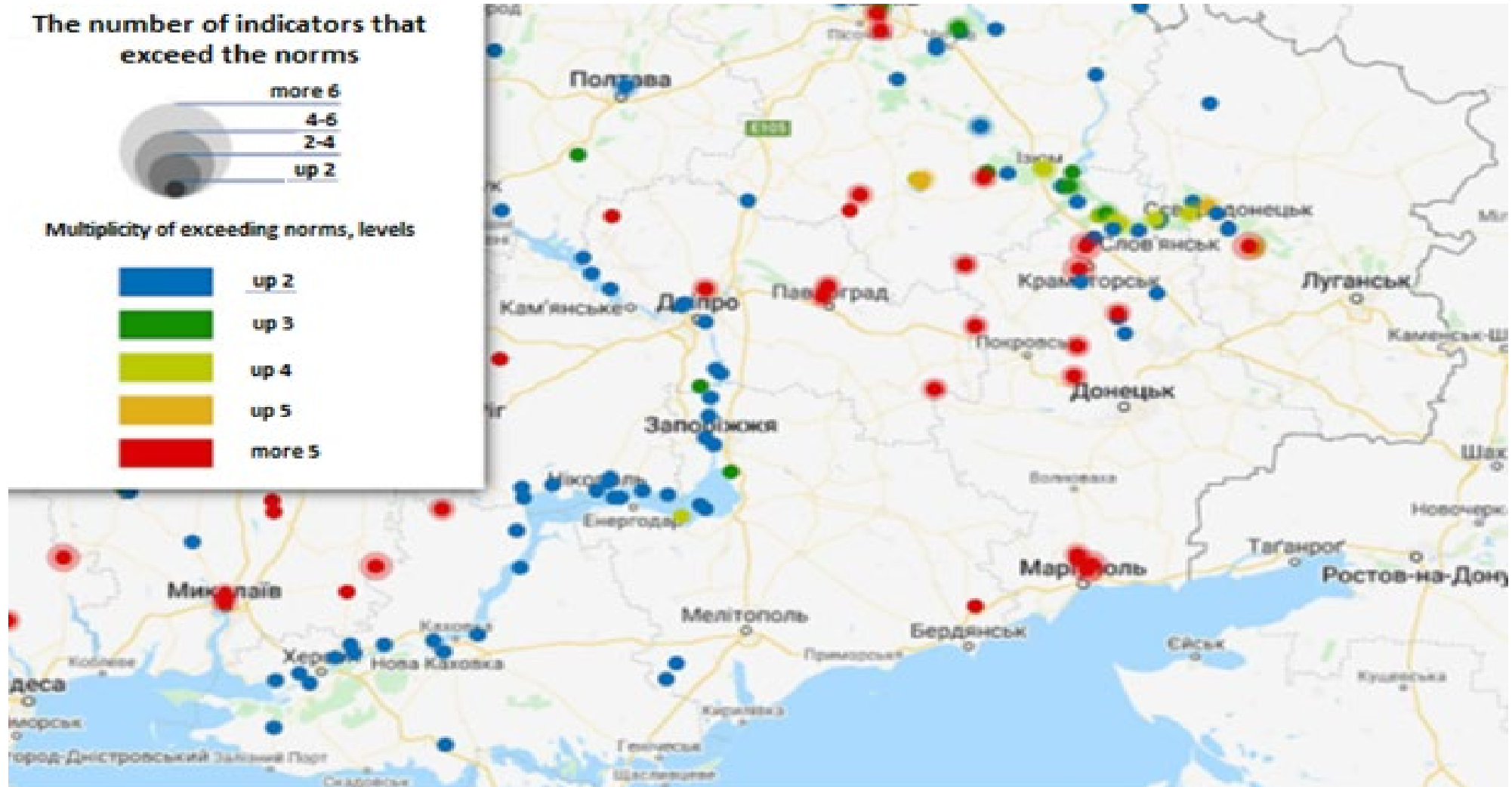
- **difficult conditions and a very large mining depth (average value ~900 m),**
- **frequent methane explosions, coal dust explosions and rock collapses (~ 75% of Ukrainian coal mines belong to the first high-risk group with an increased danger of methane explosions, 35% have a risk of coal dust explosions),**
- **outdated infrastructure and equipment, as well as a low general level of labor safety.**

This leads to a large number of accidents and fatalities:

- **during the years of independence ~ 4,000 Ukrainian miners died in ~ 40 major accidents**
- **only in 2018, about 18% of accidents in the country occurred in the mining industry, mainly in coal mines (according to the Social Insurance Fund of Ukraine),**
- **in 2016-2017 alone, about 1,600 miners were injured and 45 died, most of the accidents occurred underground (according to the State Labor Service).**

5. Such a transformation will lead to systemic changes that will affect thousands of people currently working in traditional industries, especially in the coal industry

Map of water pollution in Eastern coal regions of Ukraine



5. Such a transformation will lead to systemic changes that will affect thousands of people currently working in traditional industries, especially in the coal industry

The implementation of the Concept of the Program for the Transformation of the Coal Regions of Ukraine should solve the following social problems related to the transformation of the energy sector, which Ukraine has already faced:

- 1. creation of conditions for diversification of the economy of more than 20 coal communities, where about 850,000 people live (including 110,000 children of school and preschool age);**
- 2. increase in the number of employed populations in the real sector of the economy, not related to the coal industry (creation of new jobs and increase in self-employment of the population);**
- 3. reduction of disparities in the development of coal territories, which affects the situation in the regions and the quality of life;**
- 4. increasing the satisfaction of residents of coal-fired cities with heat supply, water supply and water quality services;**
- 5. renewal of infrastructural facilities of coal communities due to the use of effective sources and financing mechanisms within the framework of the Program's resource provision (more than 60 settlements);**
- 6. creation of three centers of creative economy and infrastructure development for five or more industrial parks (with a total area of more than 200 hectares) in coal regions;**
- 7. expansion of opportunities for professional self-realization of employees of coal enterprises through the implementation of special programs of retraining, professional training, obtaining a second education for further employment;**
- 8. reducing the dependence of local budgets on taxes and fees paid by coal enterprises (usually such dependence is more than 50 percent);**
- 9. increasing the share of capital expenditures in the structure of local budgets of coal communities to 20 percent (usually the share of capital expenditures in the budgets of coal communities is less than 5-7 percent).**

Thank you for your attention!

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