



Association of Geothermal Energy Society



Dr., Prof. Oleg Povarov

President

**Earth heat utilization and construction of combined
cycle power plants – the main trends of power
engineering development in Russia**

**IGW-2003
Sochi, Russia**

Content

- **Fossil fuel resources**
- **Main trends of energy sector development in XXI century**
- **Modern district heating systems in Russia**
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- **Geothermal heat and power – less expensive, more reliable and environmentally friendly**
- **Local geothermal heat and power supply systems**
- **GSI, BPP and utilization of heat of the Earth – main trends of energy sector development in Russia**
- **New promising geothermal projects in Russia**

World Energy Development in XXI Century

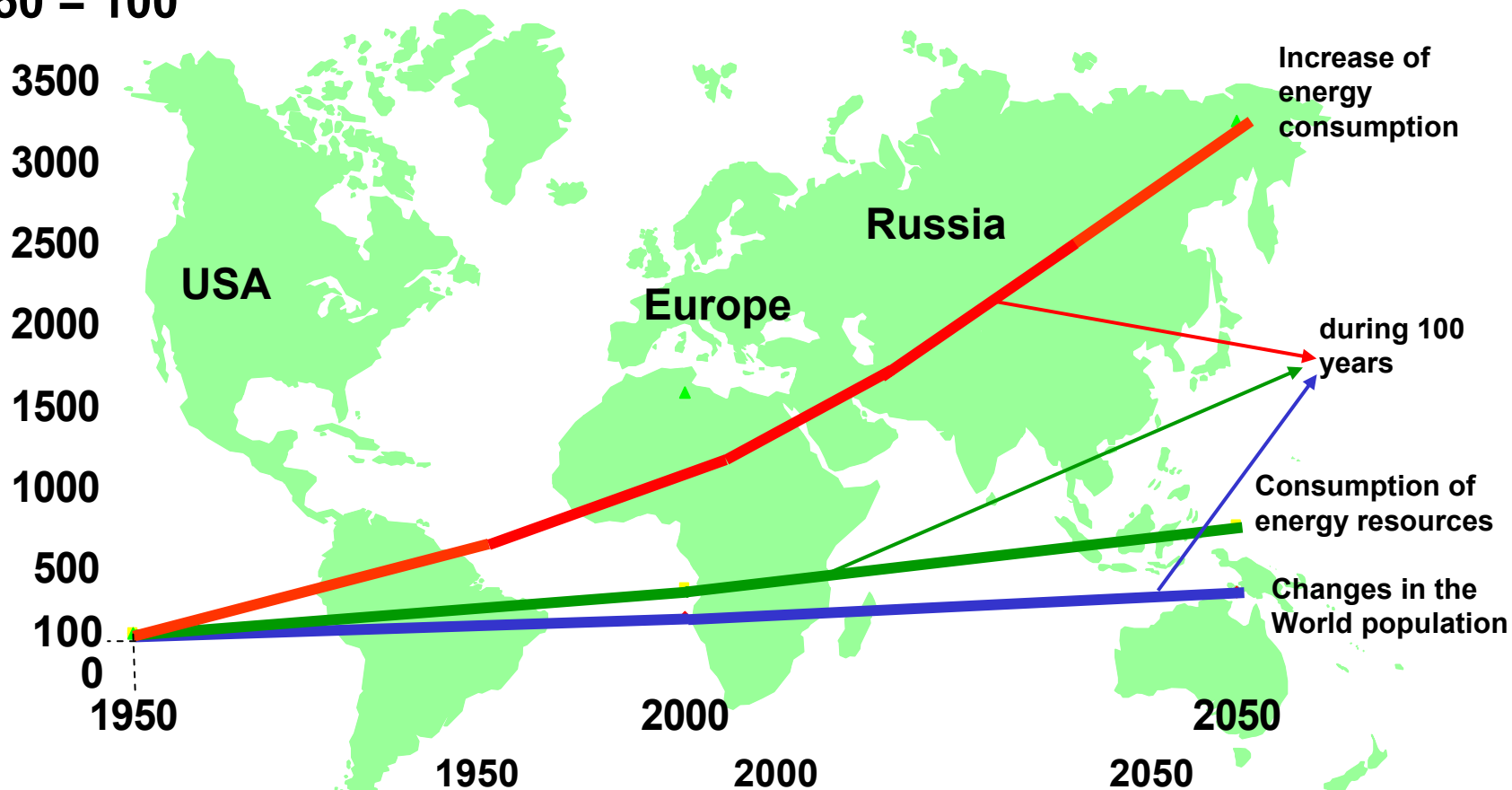
Directors Club – Siemens Power Generation Forum Europe
Berlin, June 29-30, 2001

- Until middle of XXI century there will hardly appear any new energy sources, that could radically alter the general energy balance.
- Reserves of fossil fuel (oil and gas) will be gradually running short, with their prices being constantly increased, therefore construction of NPP, TPP with high efficiency factor as well as wide utilization of local energy resources will be of first priority.
- Main trends in energy sector development until 2025 will be construction of TPP with SGI with the efficiency factor from 50% to 60%. An annual increase in SGI installed capacity is expected at 5-8%.
- NPP being high efficient and environmentally friendly power plants will be actively constructed after 2005. NPP can cover 20% of all the energy installed capacity.
- TPP with super-critical parameters of steam: $P_o = 300$ Bar and $t = 700$ °C, can generate efficiency factor up to 47% and will play an important role in the World energy sector development.
- Alternative energy sources, such as geothermal energy and wind energy, will contribute no more than 3-4% to the whole energy balance. In remote regions and some countries alternative energy sources can cover 70-95% demand for heat and energy of their population; in Russia the Earth heat utilization can satisfy 10% of the country's energy demand.
- Remote power plants and TPP will be operated through satellite control system (developed in Russia)

** The Forum was attended by 85 scientists and engineers from 42 countries.*

Energy Consumption in the World

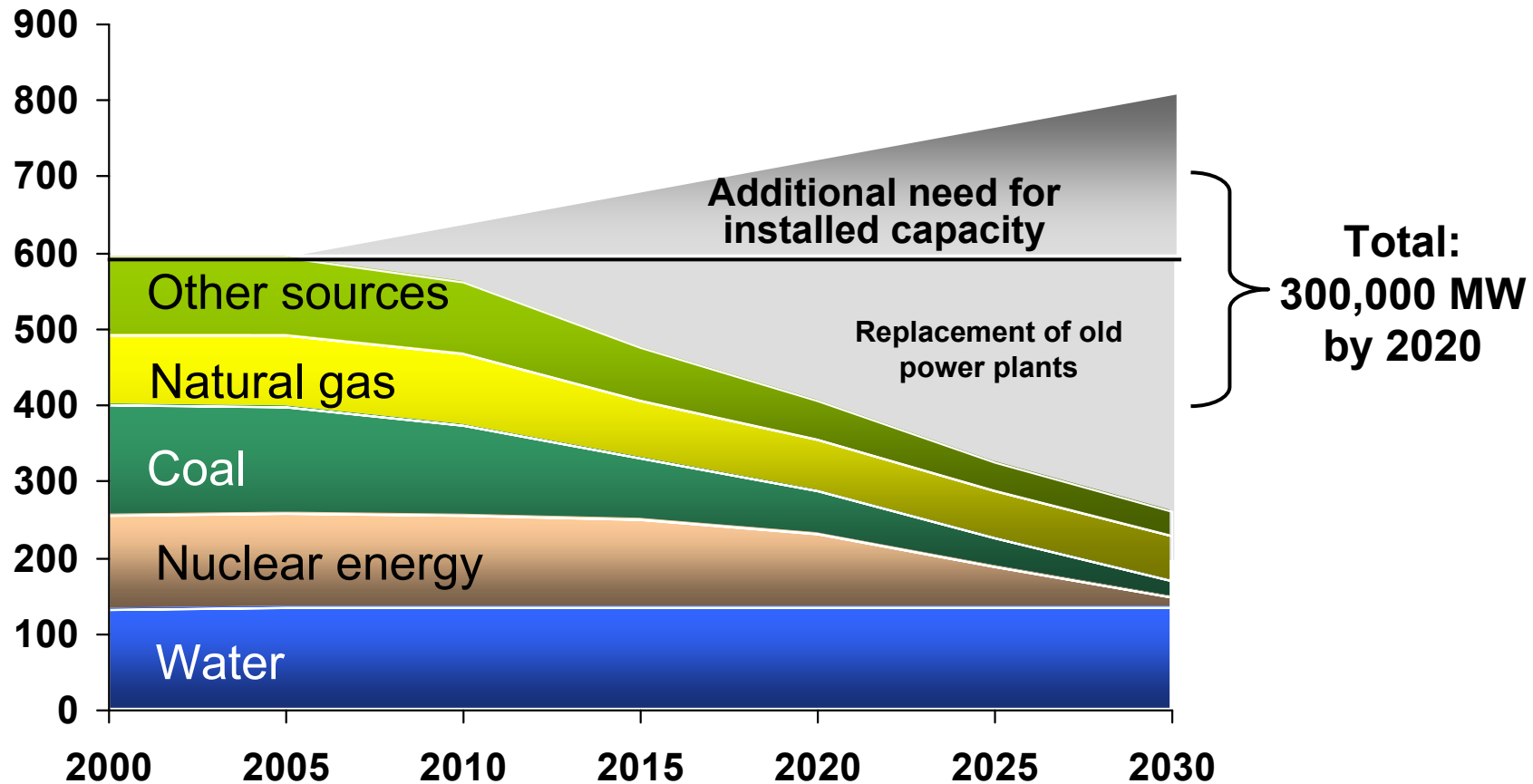
1950 = 100



Population	2,5	6,0 (x 2,4)	9,0 (x 3,6) billion of people
Consumption of energy resources	3,7	14,0 (x 3,8)	28,0 (x 7,6) billion t.e.f.
Electricity (consumption)	1,0	15,2 (x 15)	30,0 (x 30) GWh

Europe: Need for New Energy Facilities

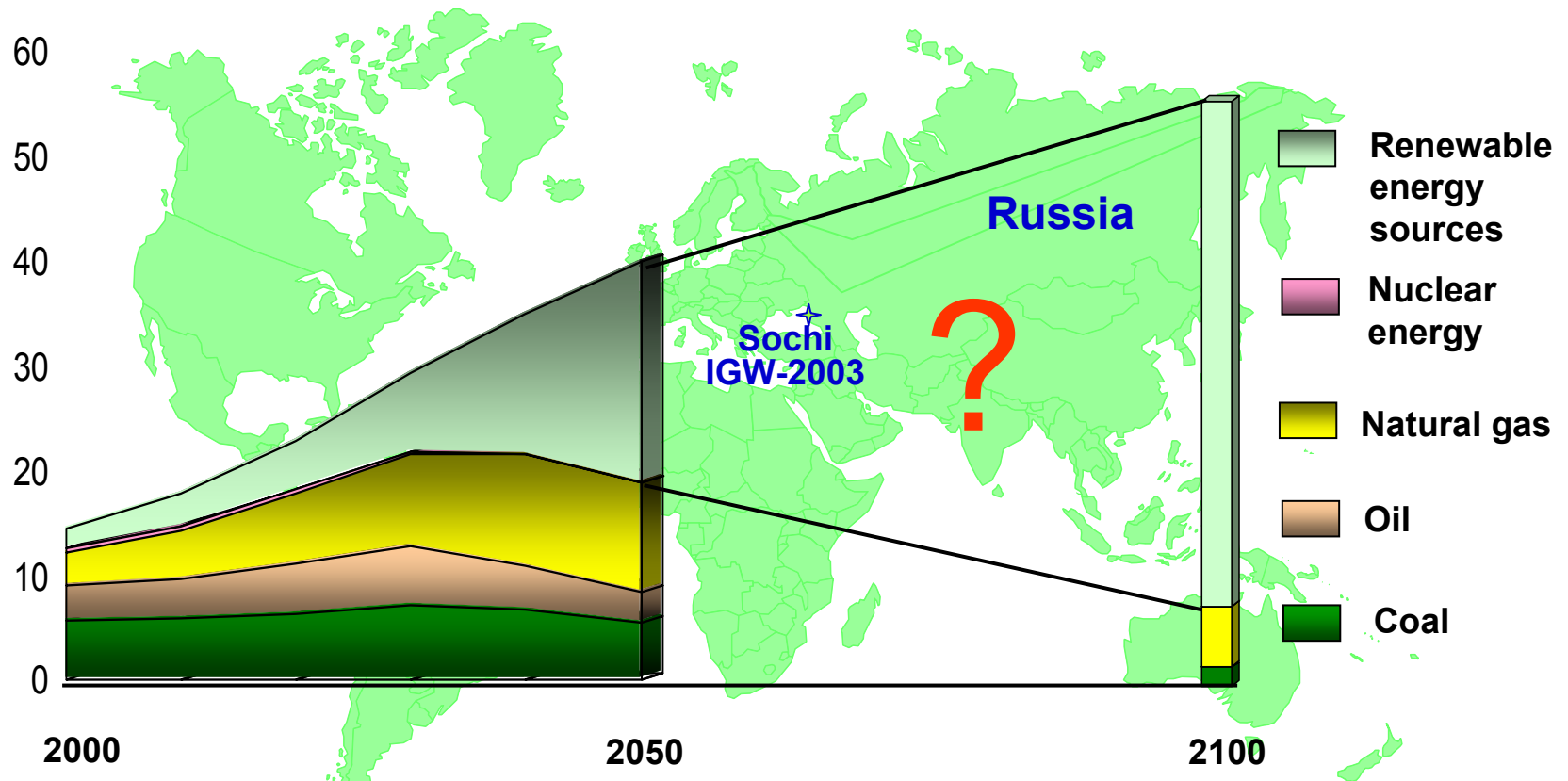
GW



Installed capacity – not older than 40 years

New era in global energy development - without fossil fuel and nuclear energy?

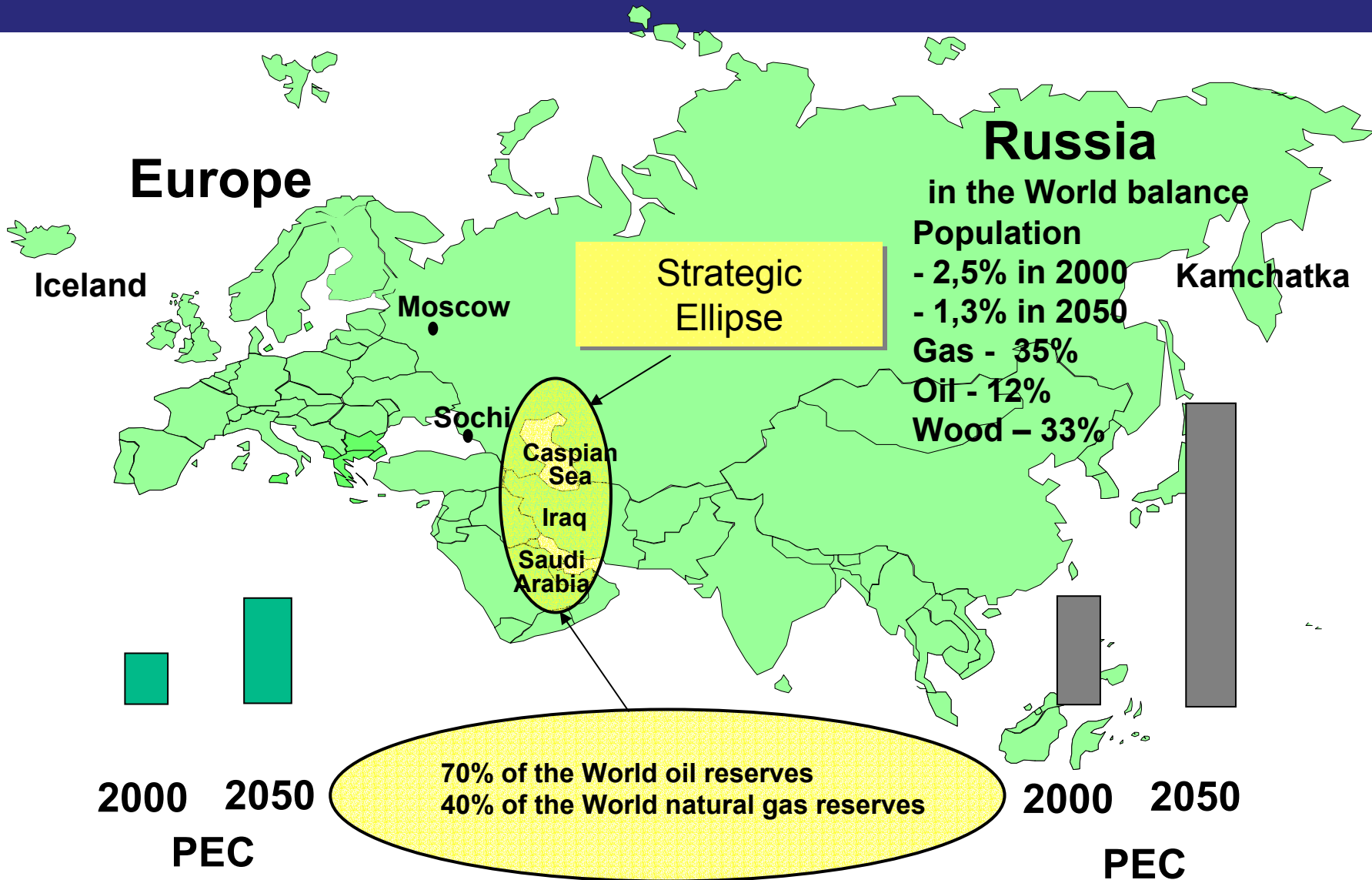
billion t.e.f.



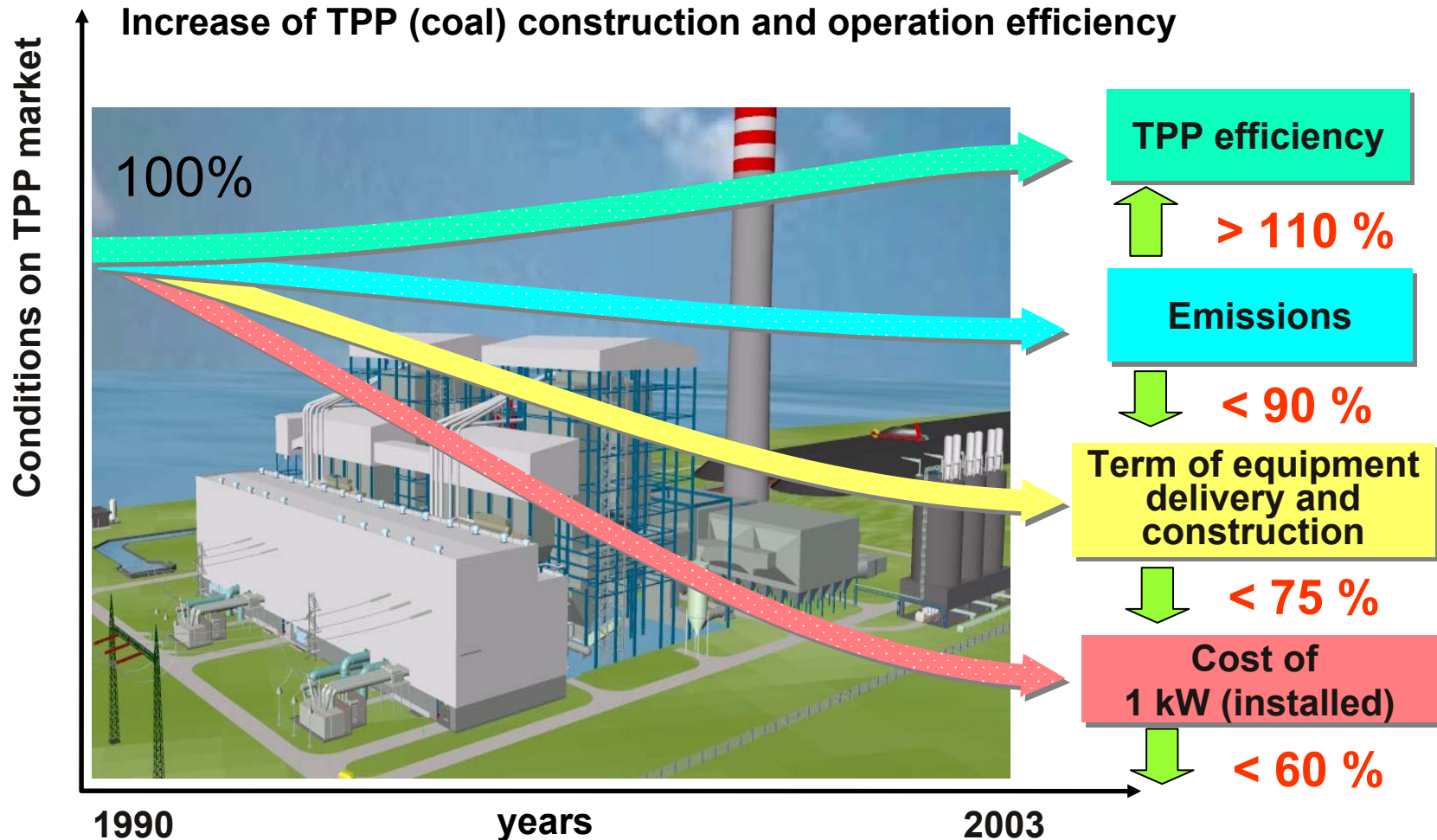
Changes in fossil fuel consumption in XXI century

	2000	2010	2020	2030	2040	2050	2100
Percentage	85	81	78	73	62	47	14
bln. t.e.f.	12.2	14.3	17.8	21.6	21.5	18.7	7.5

Energy Geopolitics: East-West

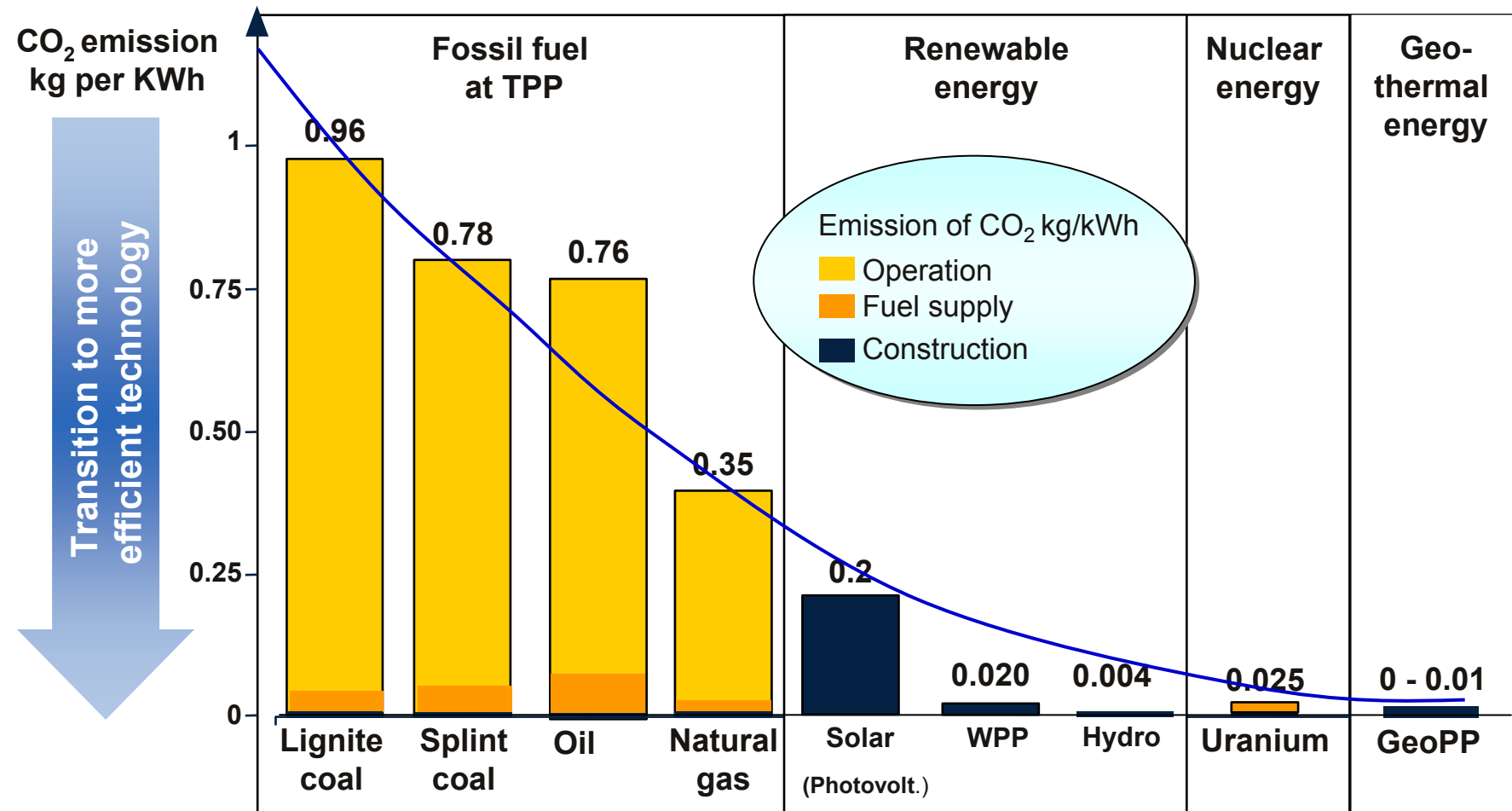


Market Conditions for Power Plants

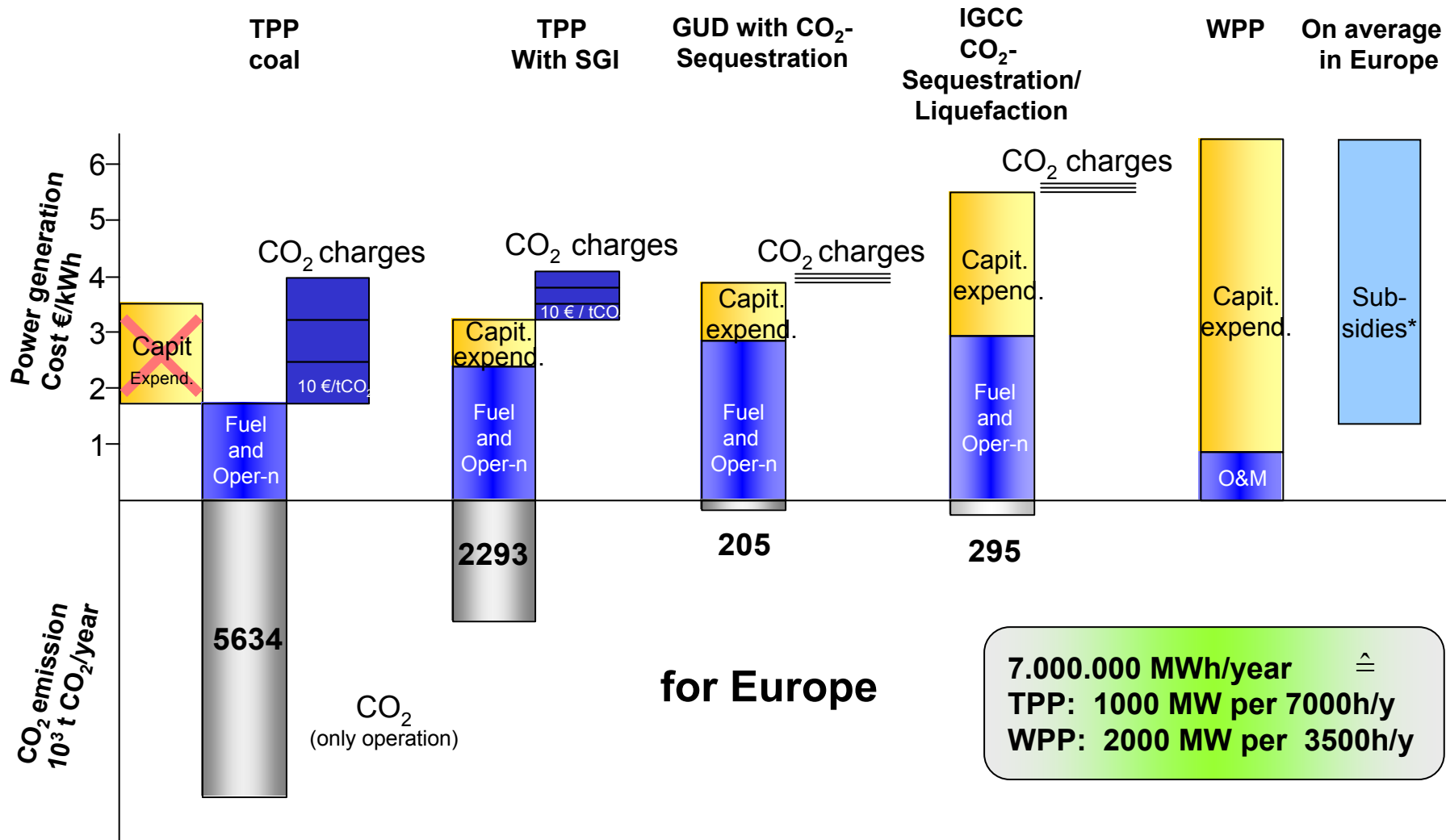


Efficiency factor at the best TPP reaches today 48,6%

CO₂ Emission and Methods of Emission Reduction at Different Types of Power Plants

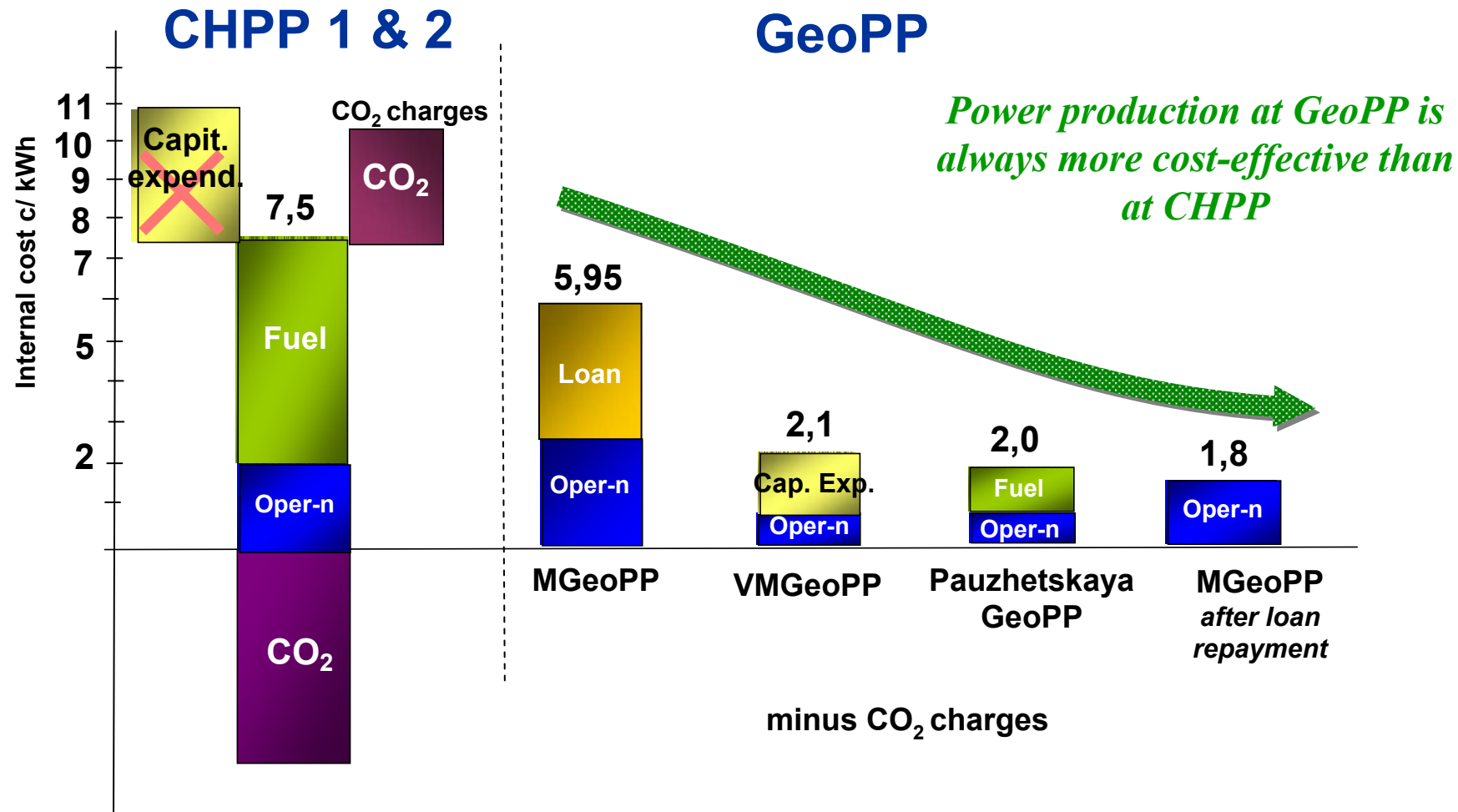


Methods of CO₂ Emission Reduction – Taxation and Subsidies

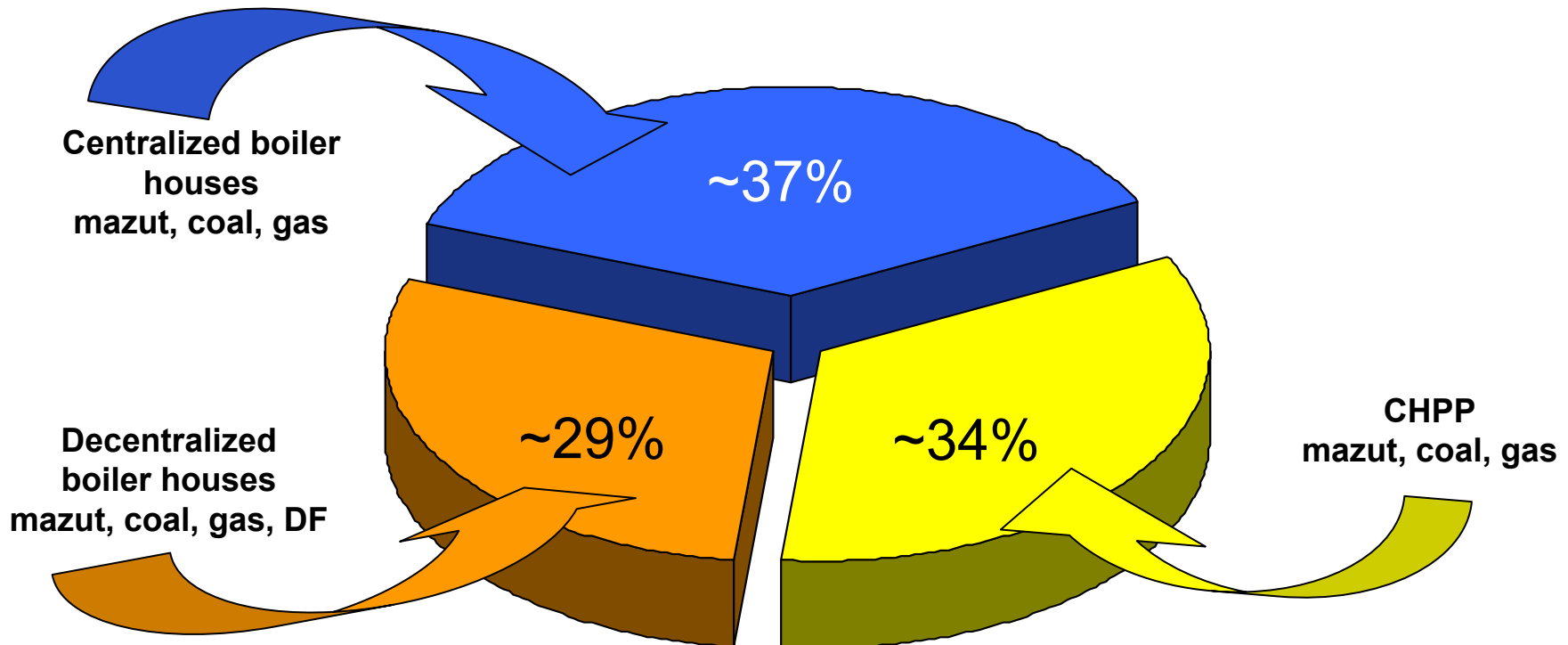


While calculating CO₂ charges per 1 ton were taken at USD 11.0

Internal Cost of 1 kW/h of Electricity at GeoPP and CHPP in Kamchatka



In Russia more that 45% of all consumed energy resources are used for heat supply



In Russia 50-60% of fossil energy resources utilized for heat supply can be replaced by environmentally friendly and more cost-effective heat of the Earth

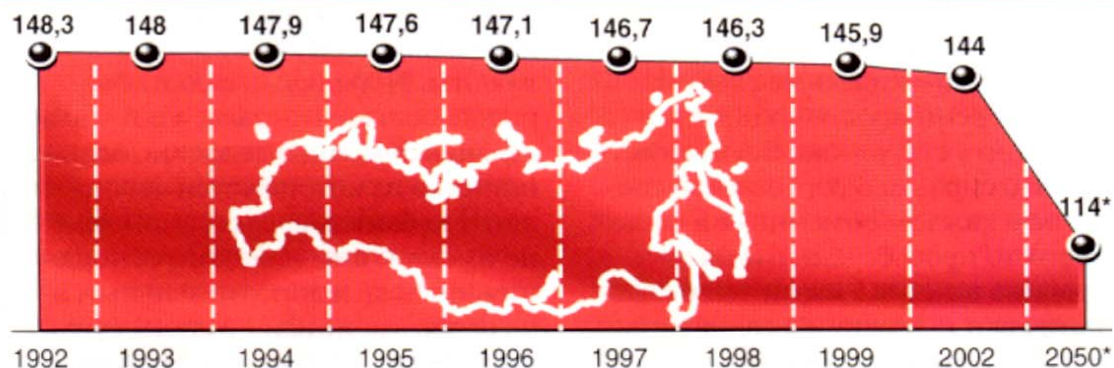
World Population

Население Земли, по прогнозам ООН, в 2050 году увеличится до 9,3 млрд. человек, в то время как население России уменьшится до 114 млн. человек

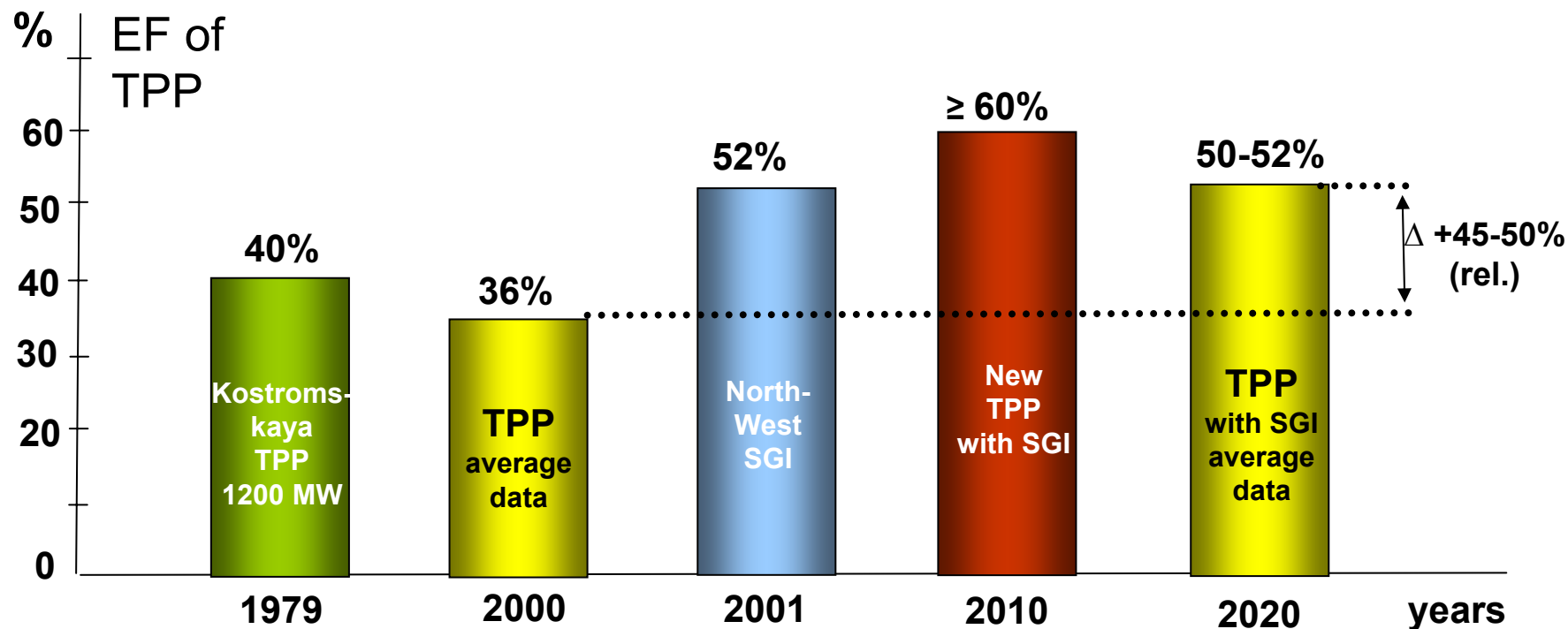
НАСЕЛЕНИЕ ПЛАНЕТЫ, млрд. чел.



НАСЕЛЕНИЕ РОССИИ, млн. чел.



In Russia efficiency factor (EF) of TPP will increase by 45-50% (relative) to 50-52% over the next 15-20 years



Specific greenhouse gas emission will decrease by 60-70%



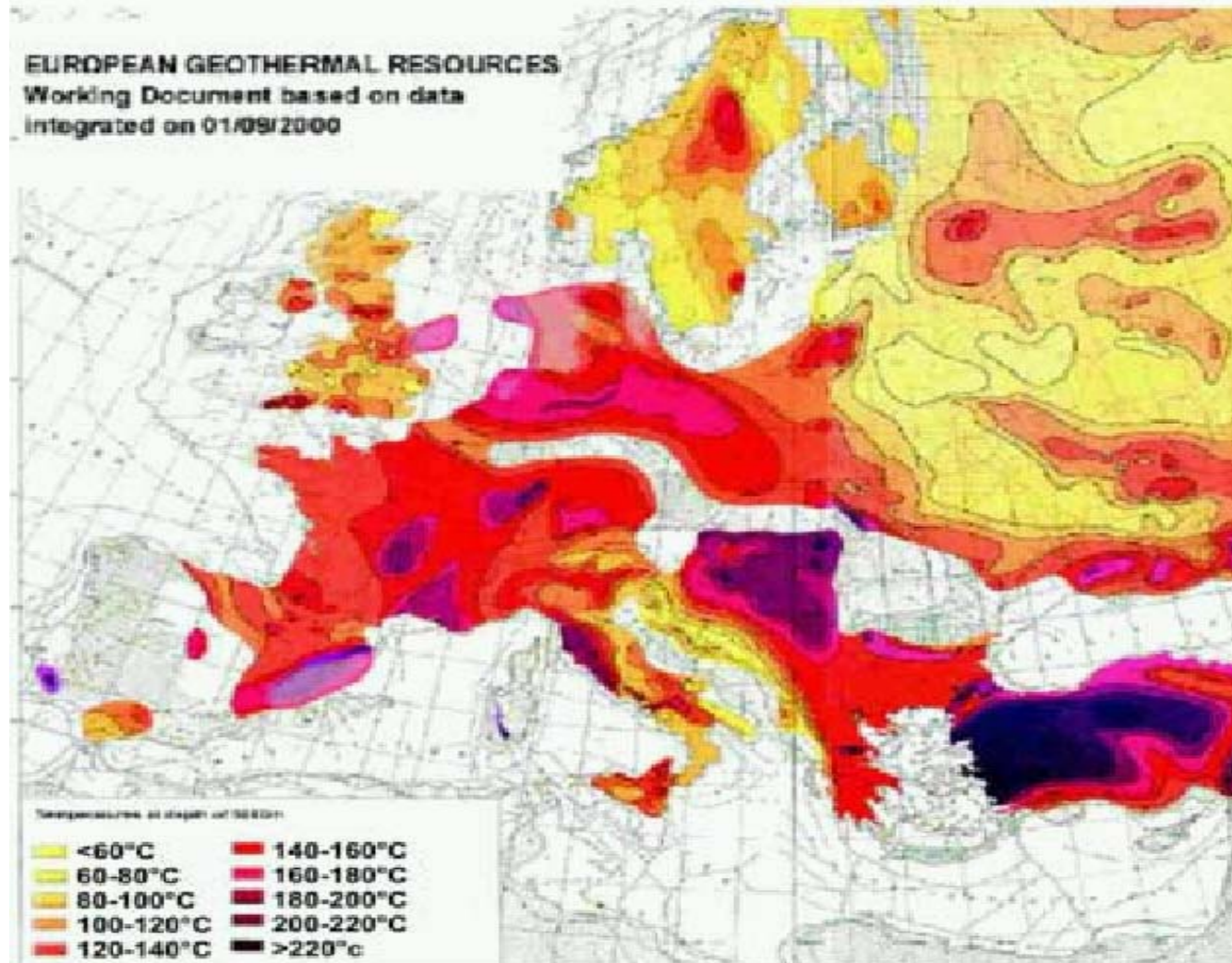
Geothermal Resources of Russia

■ **High temperature geothermal resources (GeoPP)**

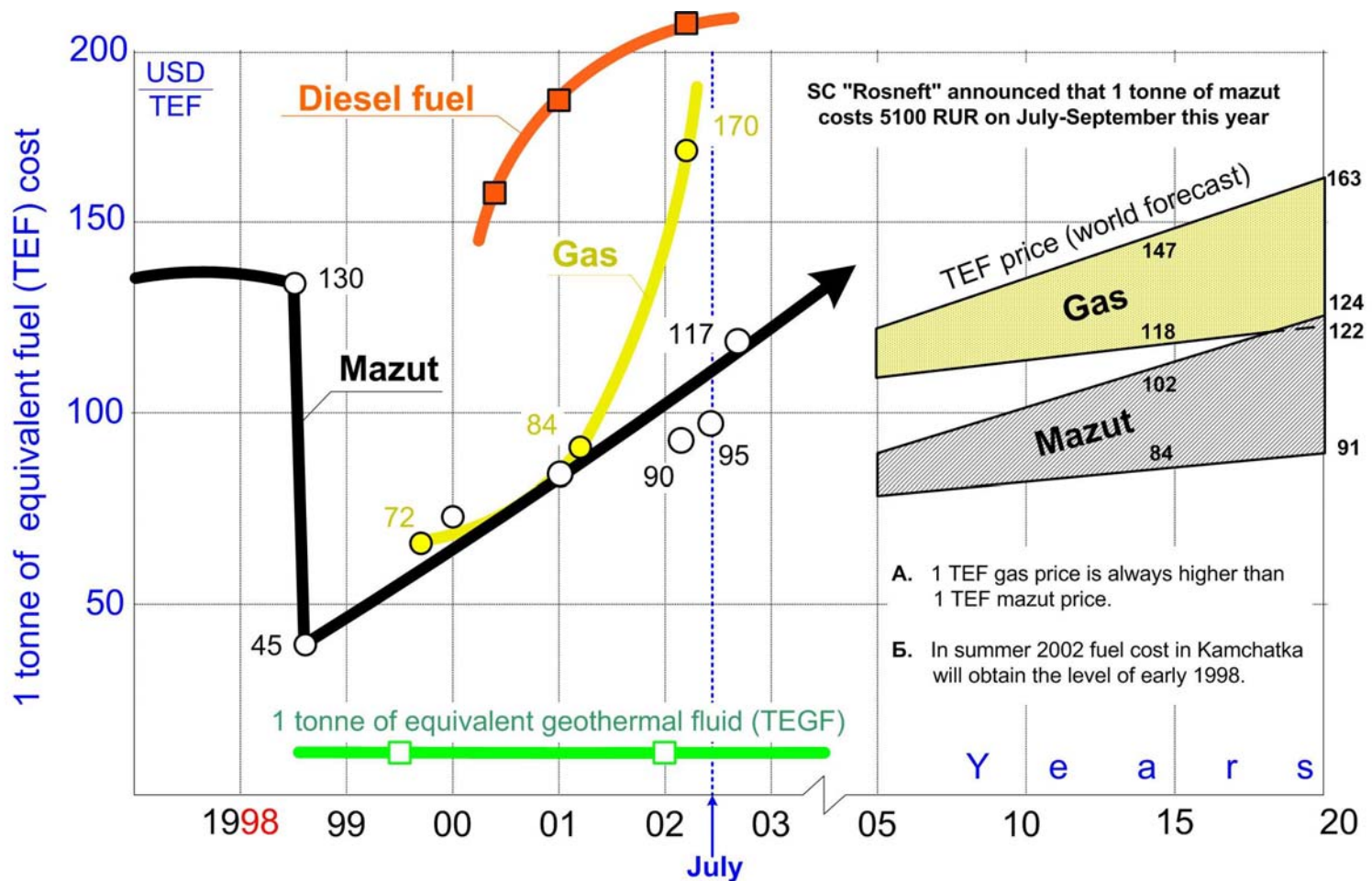
■ **Low temperature geothermal resources (GeoTPP)**



Geothermal Resources of Europe



Fuel Cost in Kamchatka



Fuel cost (mazut, diesel fuel, natural gas and geothermal fluid) in Kamchatka within time

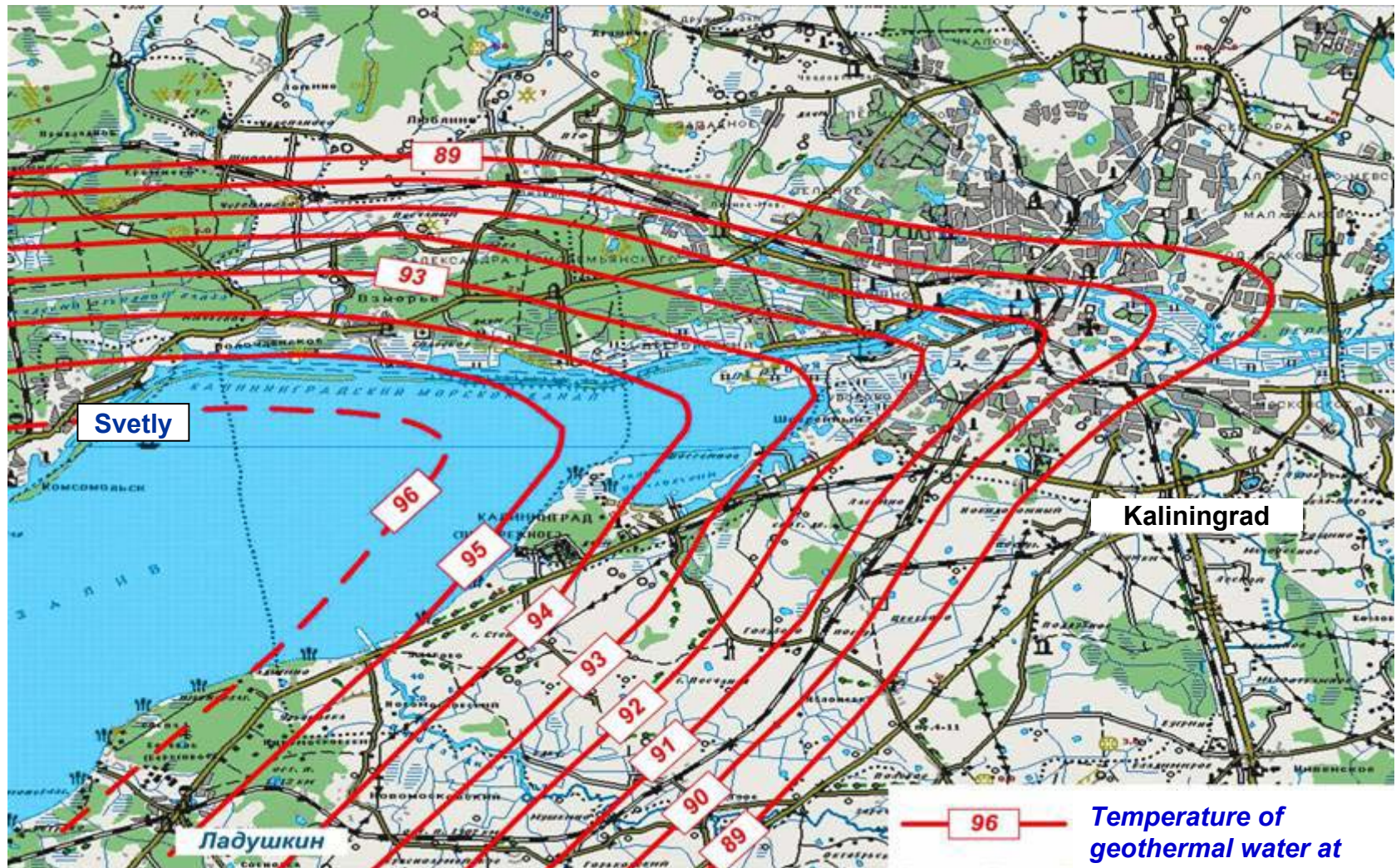
Environmentally friendly Verkhne-Mutnovsky GeoPP (is in operation since 1999)



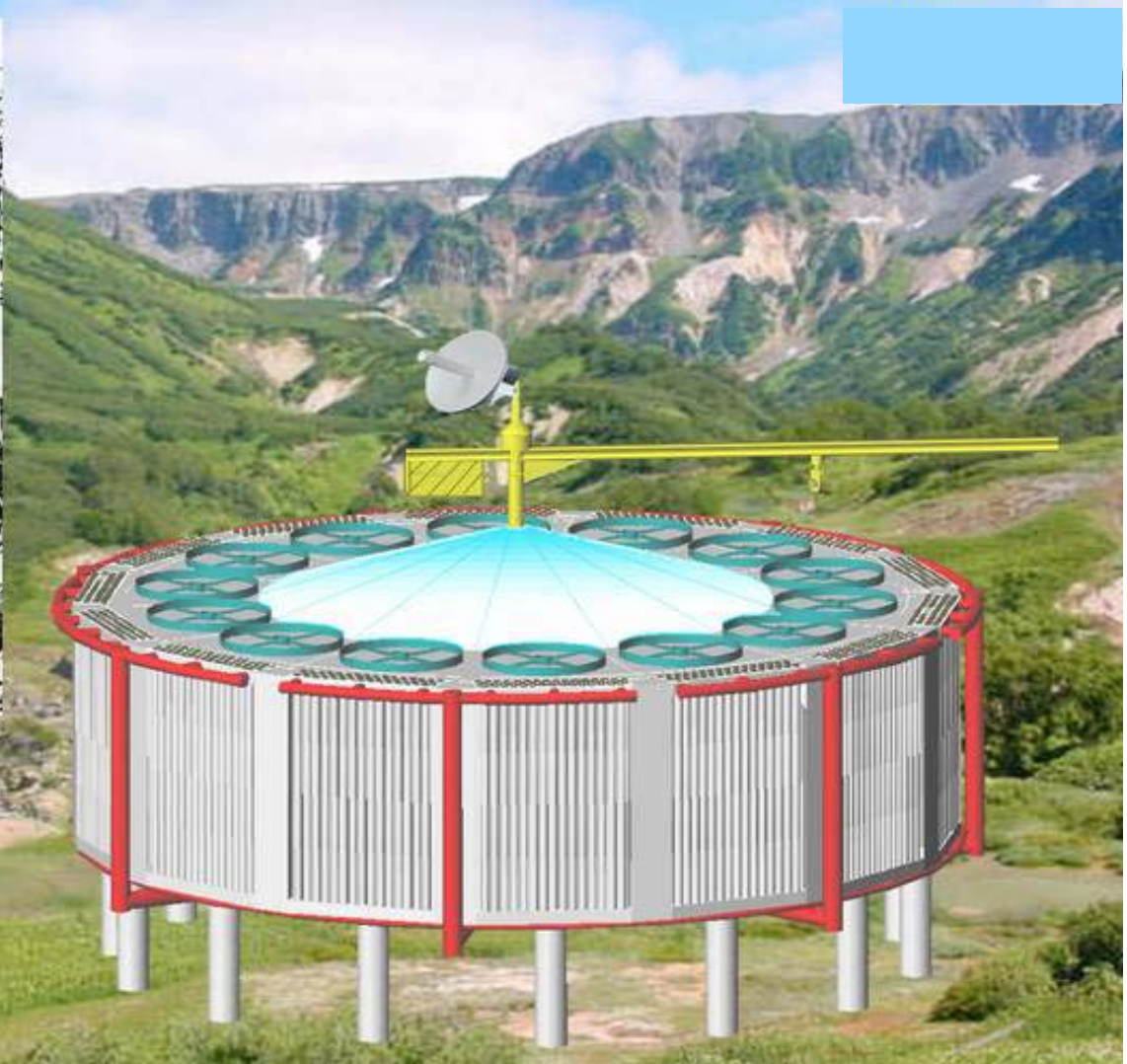
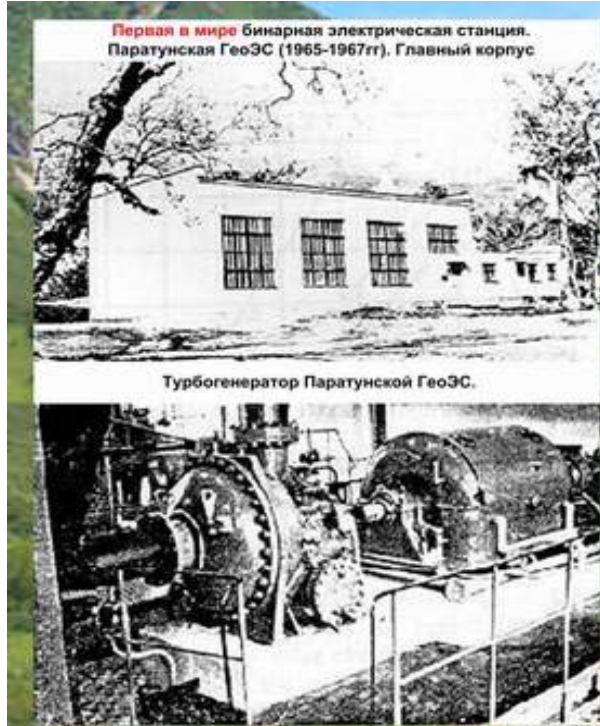
50 (2X25) MW Mutnovsky GeoPP



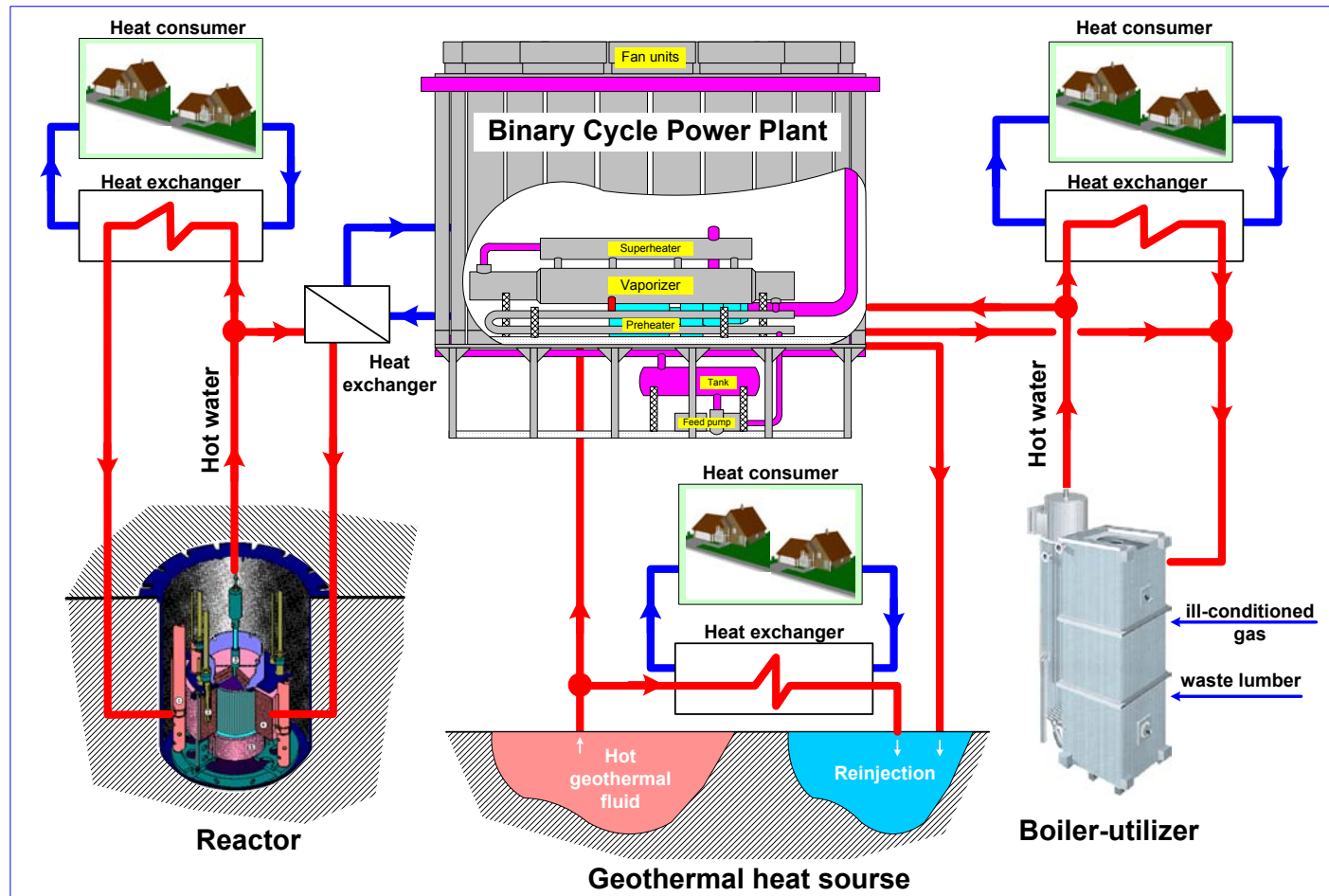
Geothermal Water Temperature Distribution in Kaliningrad Region



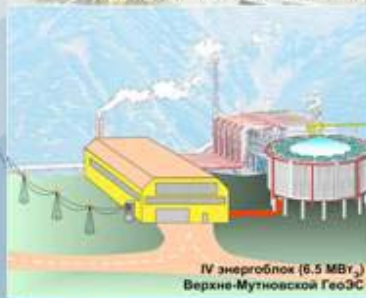
Automated 1-12 MW Binary Power Plant



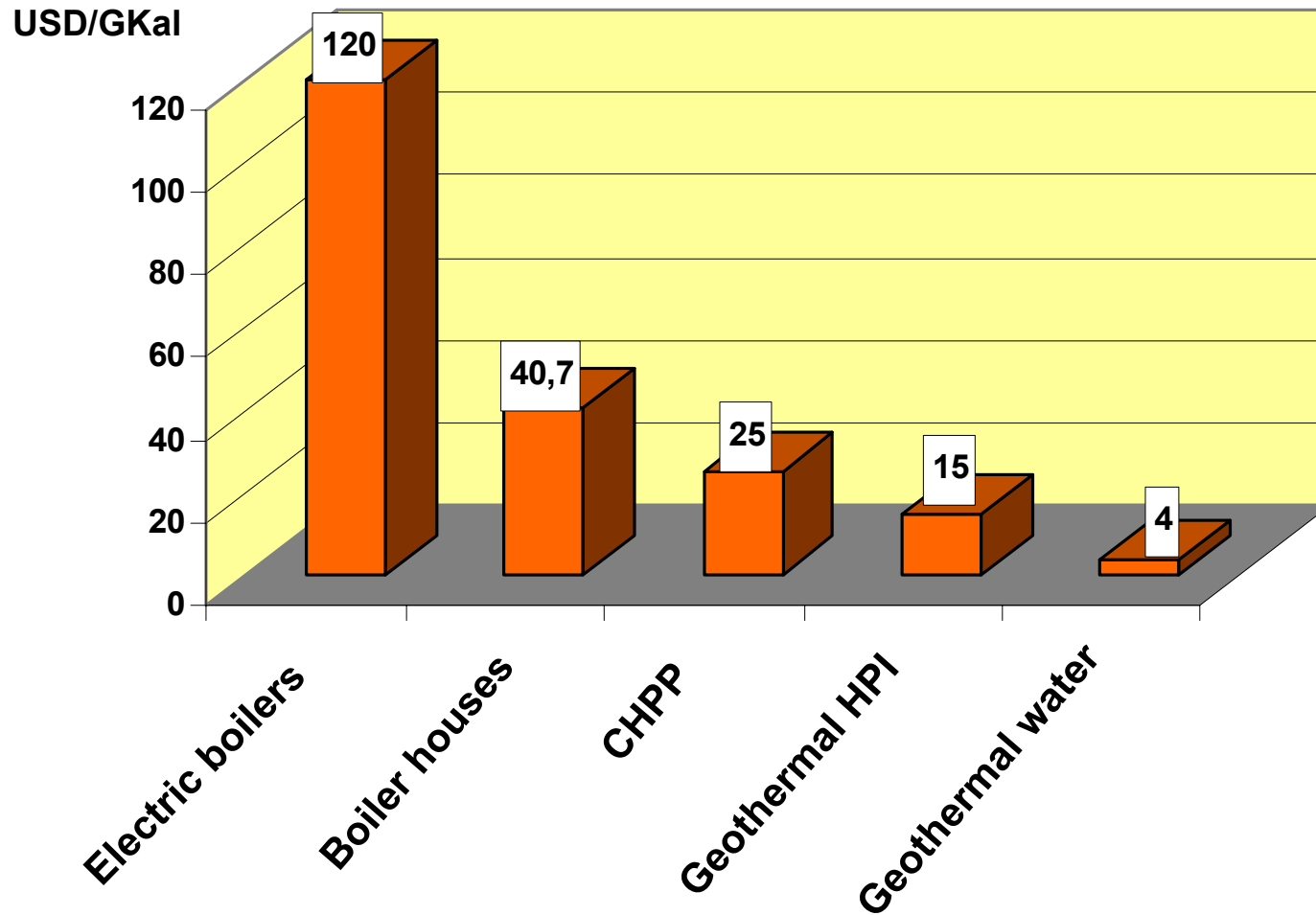
BPP in the System of Local Heat and Power Supply



Centers of Geothermal Heat Utilization in Elizovo Region

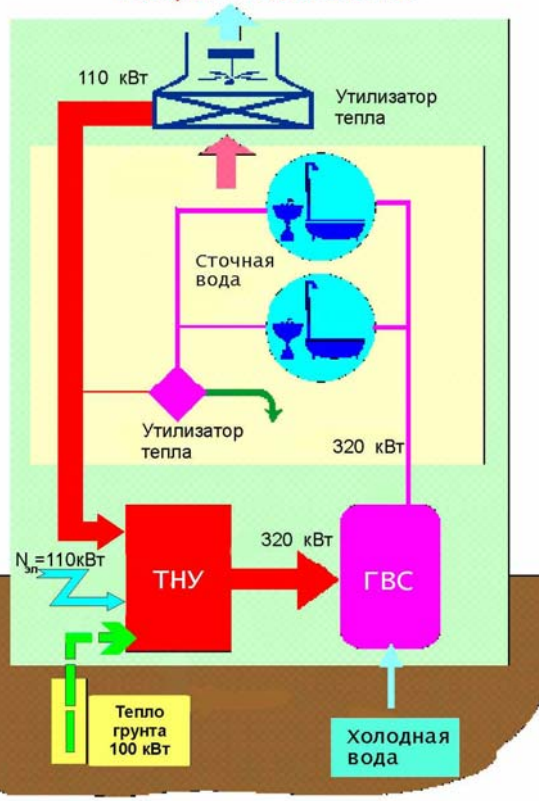


Cost of 1 GKal of Heat in Kamchatka

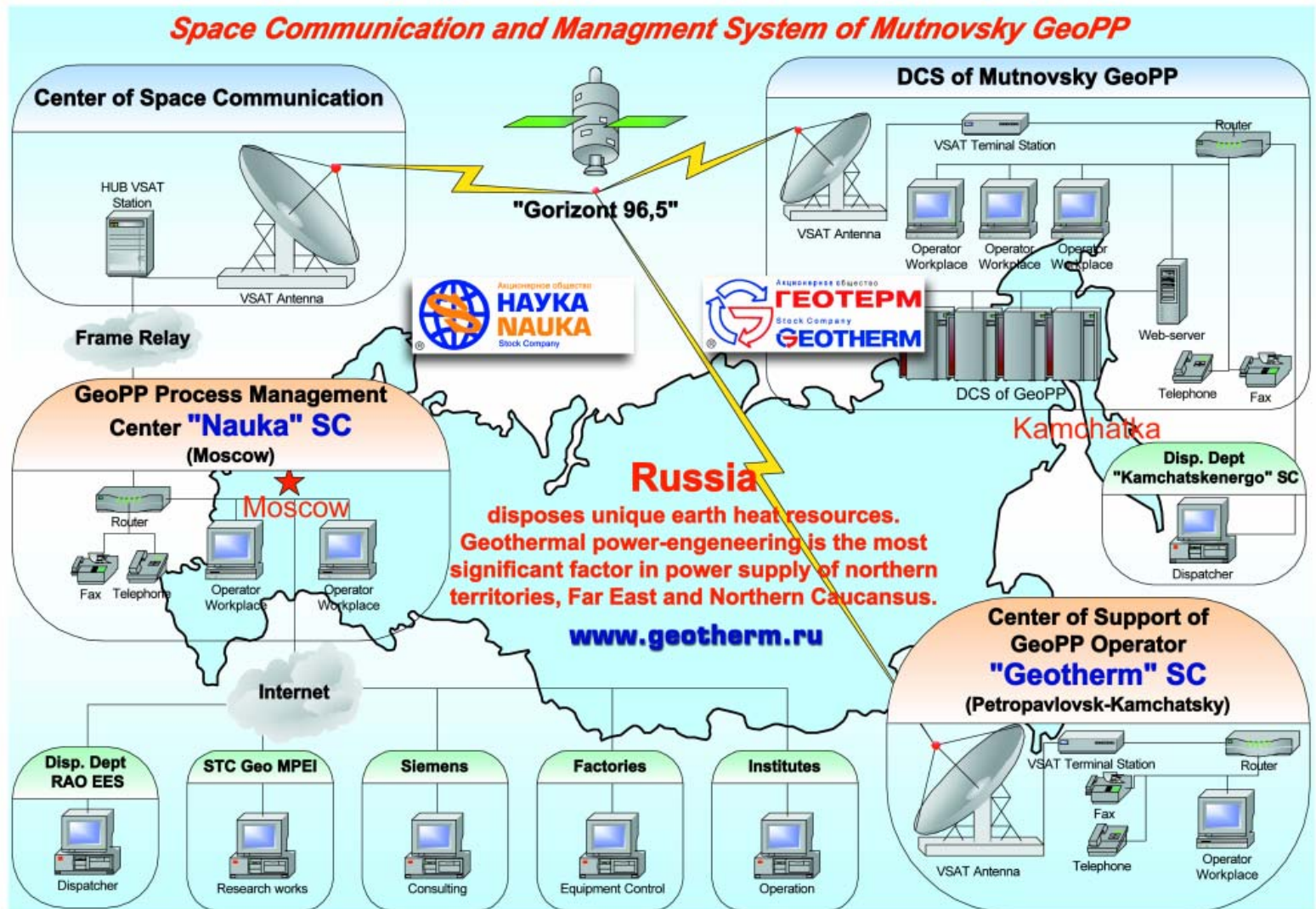


Scheme of complex heat utilization for hot water supply of 18-storey building in Moscow with application of heat pumps

Схема комплексной утилизации теплоты на горячее водоснабжение



GeoPP Satellite Control System



New Geothermal Projects in Russia

KALININGRAD REGION:

- ❖ Heat and power supply of Svetly with utilization of geothermal resources.
- ❖ Heat and power supply of Kaliningrad with utilization of geothermal resources.
- ❖ Development of the Map of geothermal resources of Kaliningrad region

MOSCOW REGION:

- ❖ Establishment of the Demonstration Center of RES utilization through wide application of district heating systems based on heat of the earth (heat pumps) in "Fili" region

SRAVROPOLSKY KRAI:

- ❖ Local heat and power supply of industrial and residential buildings through utilization of Kuzminsky geothermal field resources

DAGESTAN REPUBLIC:

- ❖ Geothermal district heating system of Kizlyar city

KRASNODAR KRAI:

- ❖ Geothermal district heating system of Labinsk city
- ❖ Geothermal district heating system of Ust-Labinsk city
- ❖ Complex utilization of geothermal resources in Mostovskaya settlement

KAMCHATKA REGION:

- ❖ Full heat and power supply of Elizovo region based on geothermal resources.
- ❖ Construction of binary power plant (IV Unit) at the Verkhne-Mutnovsky Geopp

OMSKY REGION:

- ❖ Demonstration Project "Geothermal district heating system of Chistovo city"

