Association of Geothermal Energy Society

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President

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

IGW-2003
Sochi, Russia

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- Main trends of energy sector development in XXI century
- Modern district heating systems in Russia
- Geothermal resources of Russia
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- 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

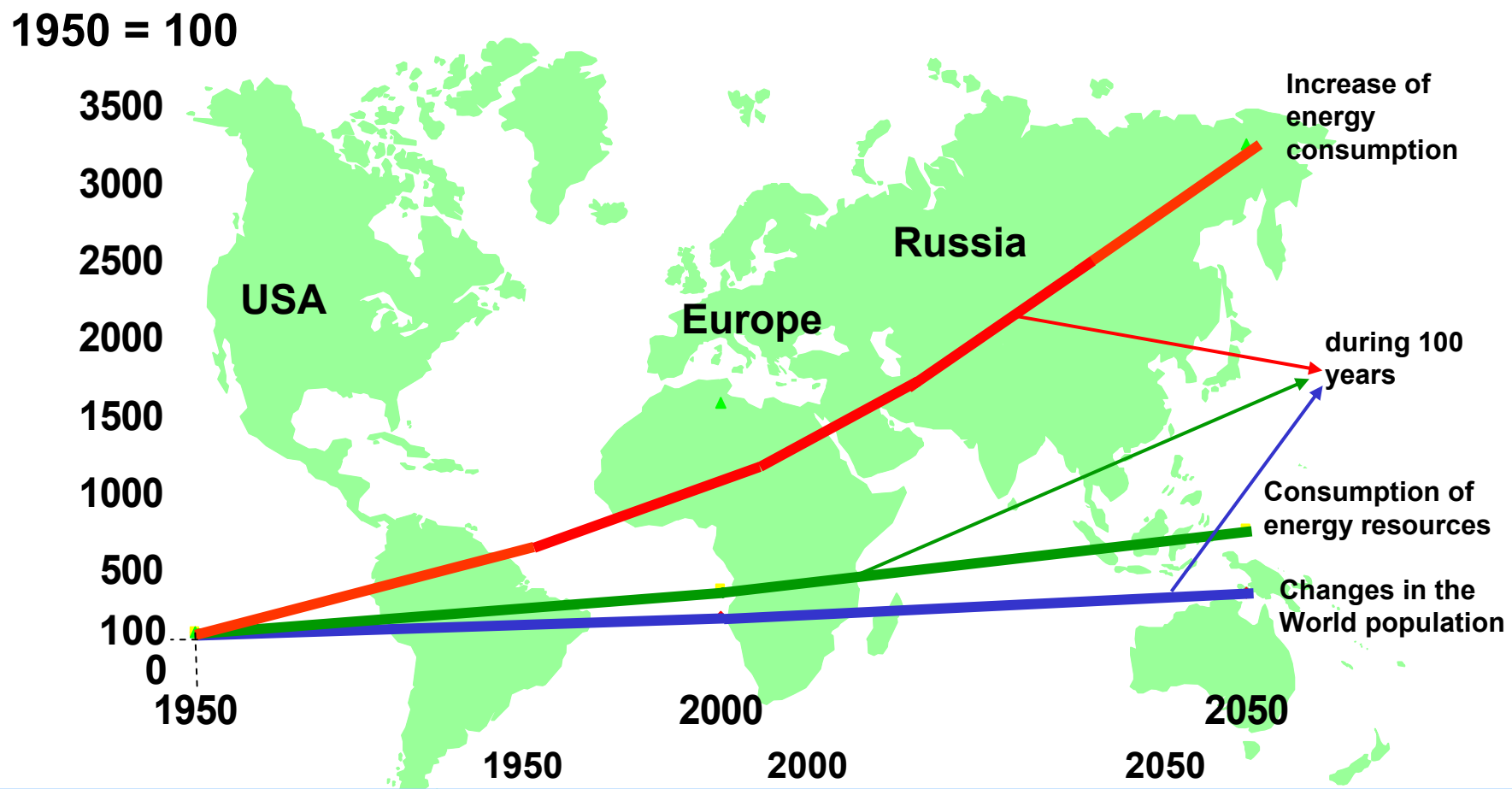
World Energy Development in XXI Century

Directors Club – Siemens Power Generation Forum Europ
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: Po = 300 Bar and t = 700 ^{0}C, can generate efficiency factor up to 47% and will play an important rile 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)

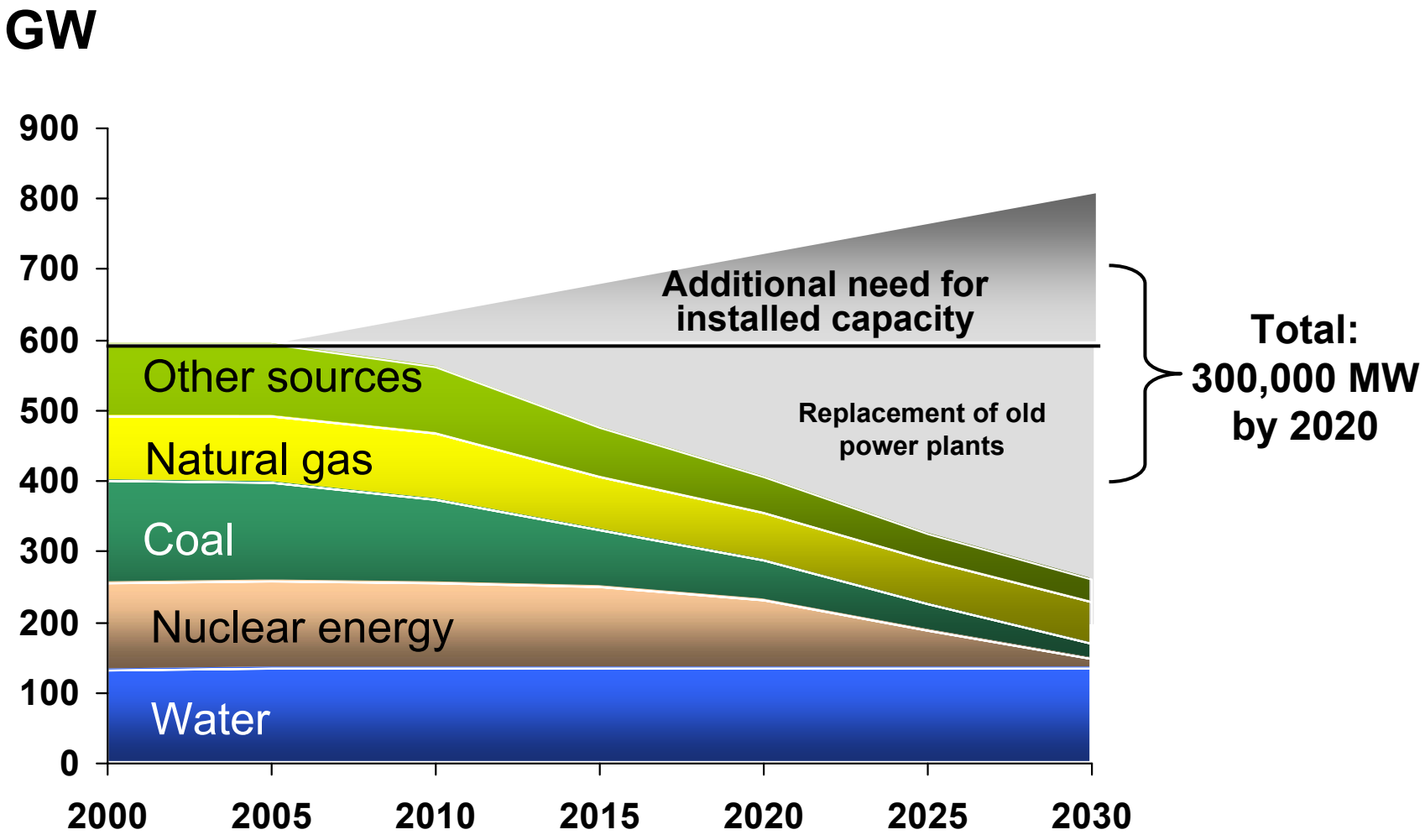
* *The Forum was attended by 85 scientists and engineers from 42 countries.*

Energy Consumption in the World



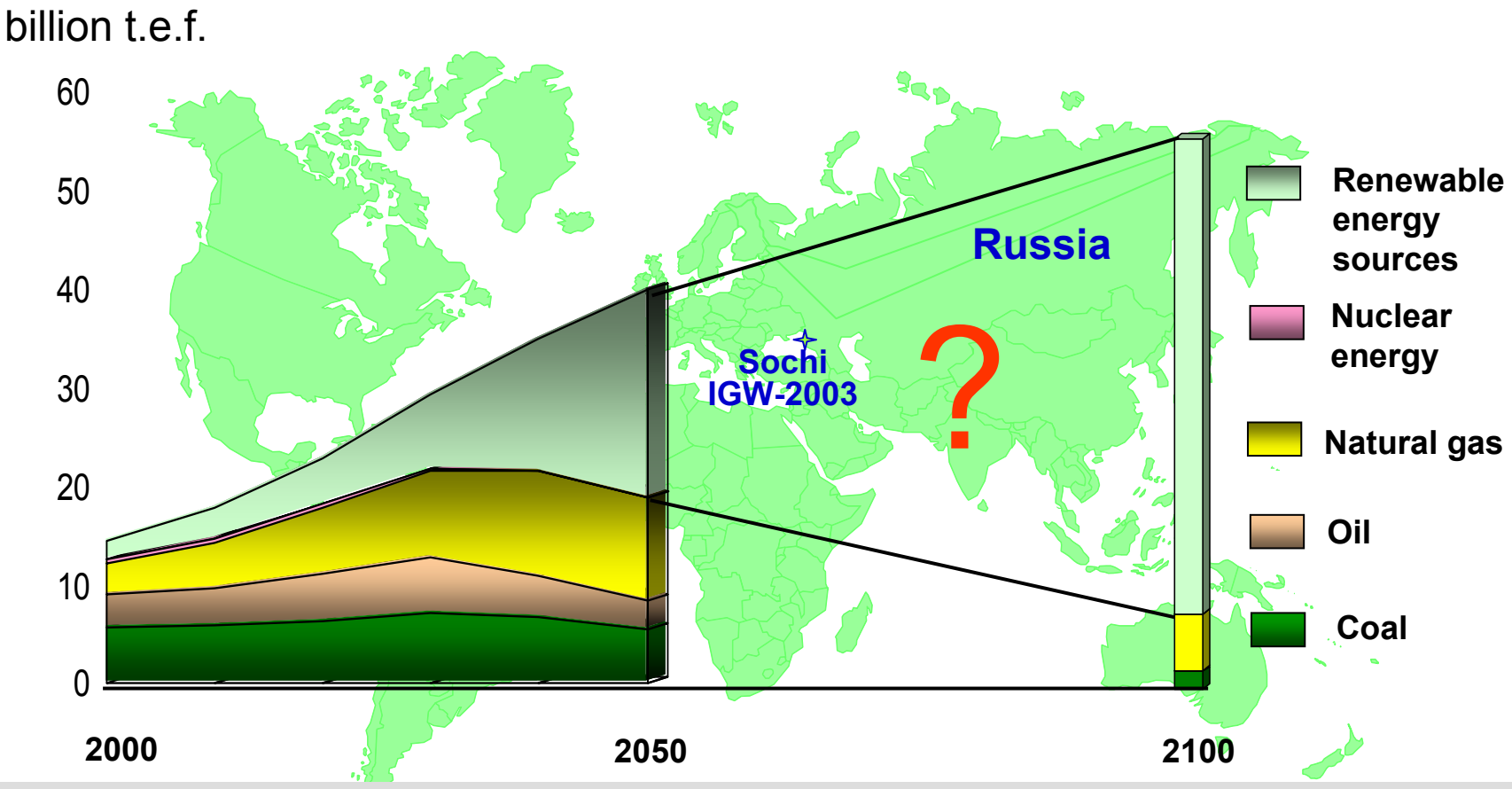
	1950		2000	2050
Population	2,5		6,0 (x 2,4)	9,0 (x 3,6) billion of people
Consumption of energy resources	3,7	1,0	14,0 (x 3,8)	28,0 (x 7,6) billion t.e.f.
Electricity (consumption)	1,0		15,2 (x 15)	30,0 (x 30) GWh

Europe: Need for New Energy Facilities



Installed capacity – not older than 40 years

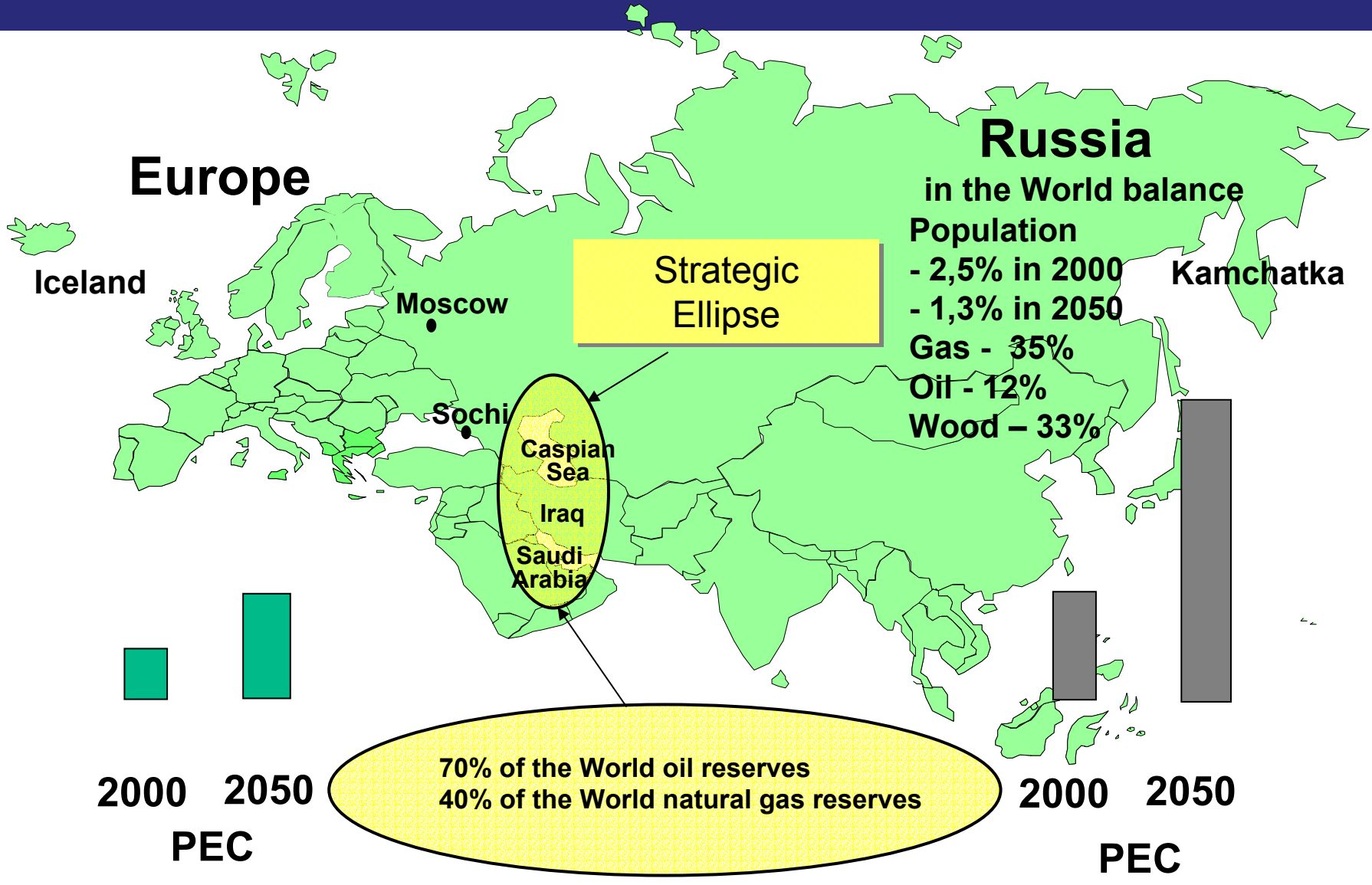
New era in global energy development - without fossil fuel and nuclear energy?



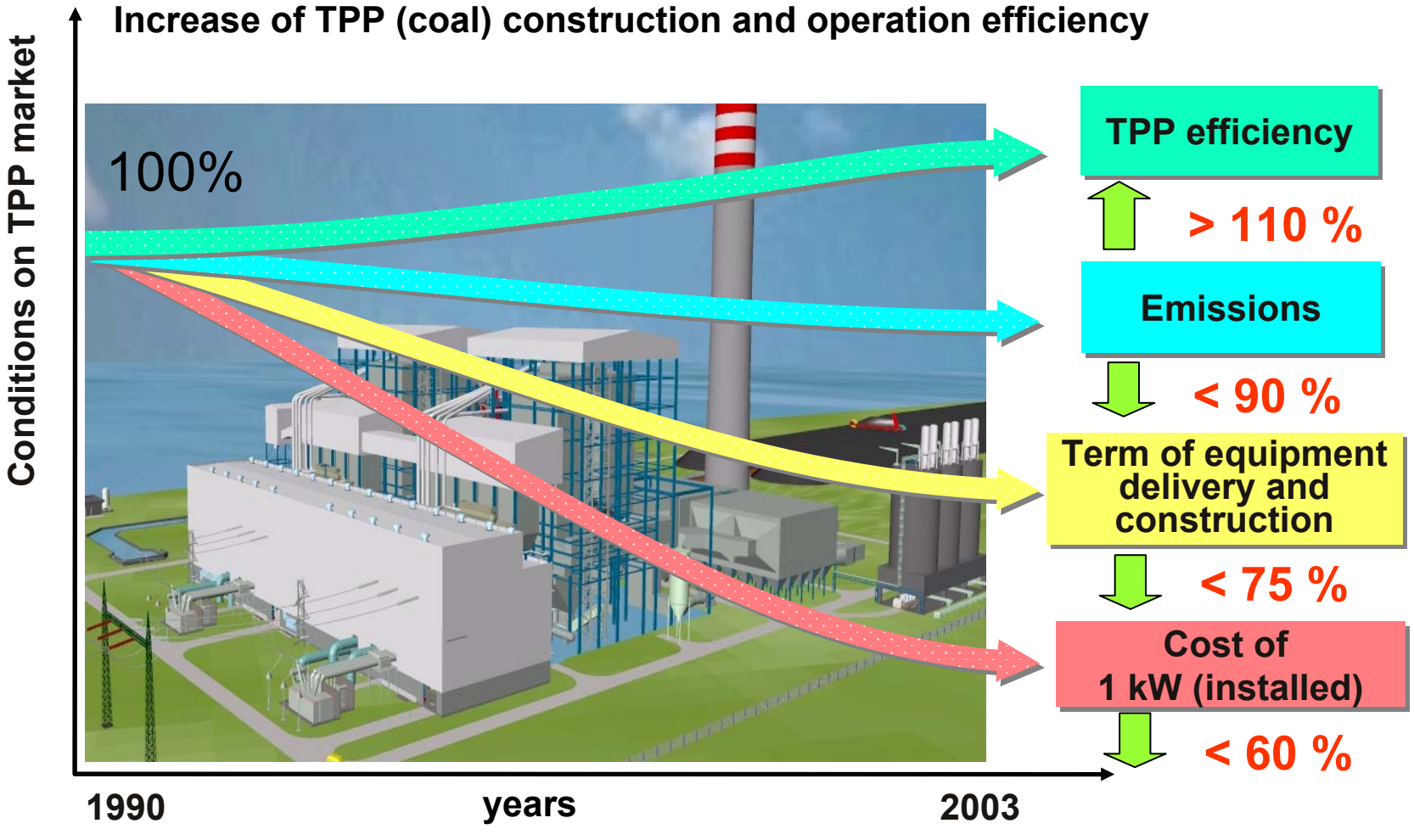
Changes in fossil fuel consumption in XXI century

	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

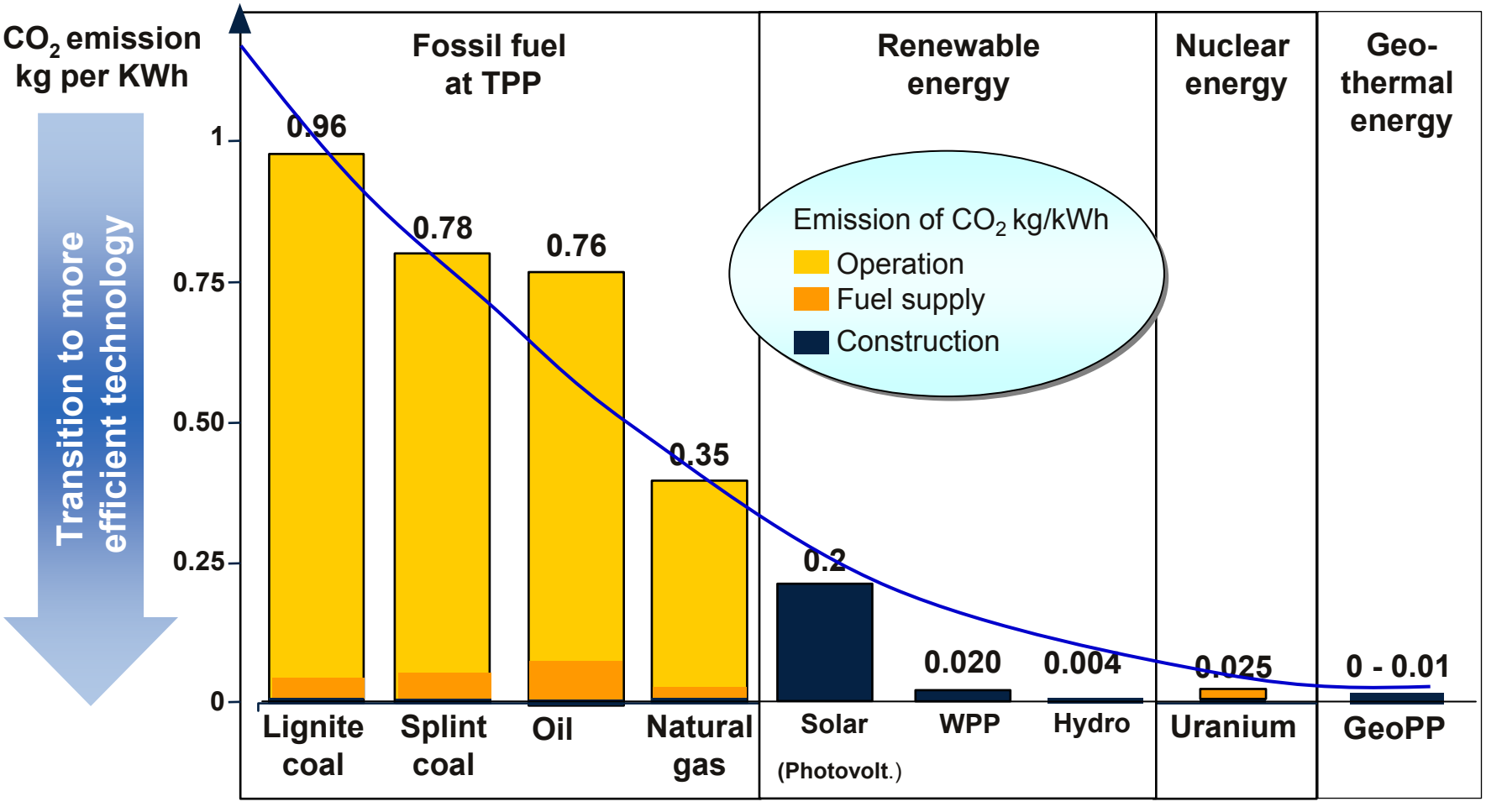


Market Conditions for Power Plants

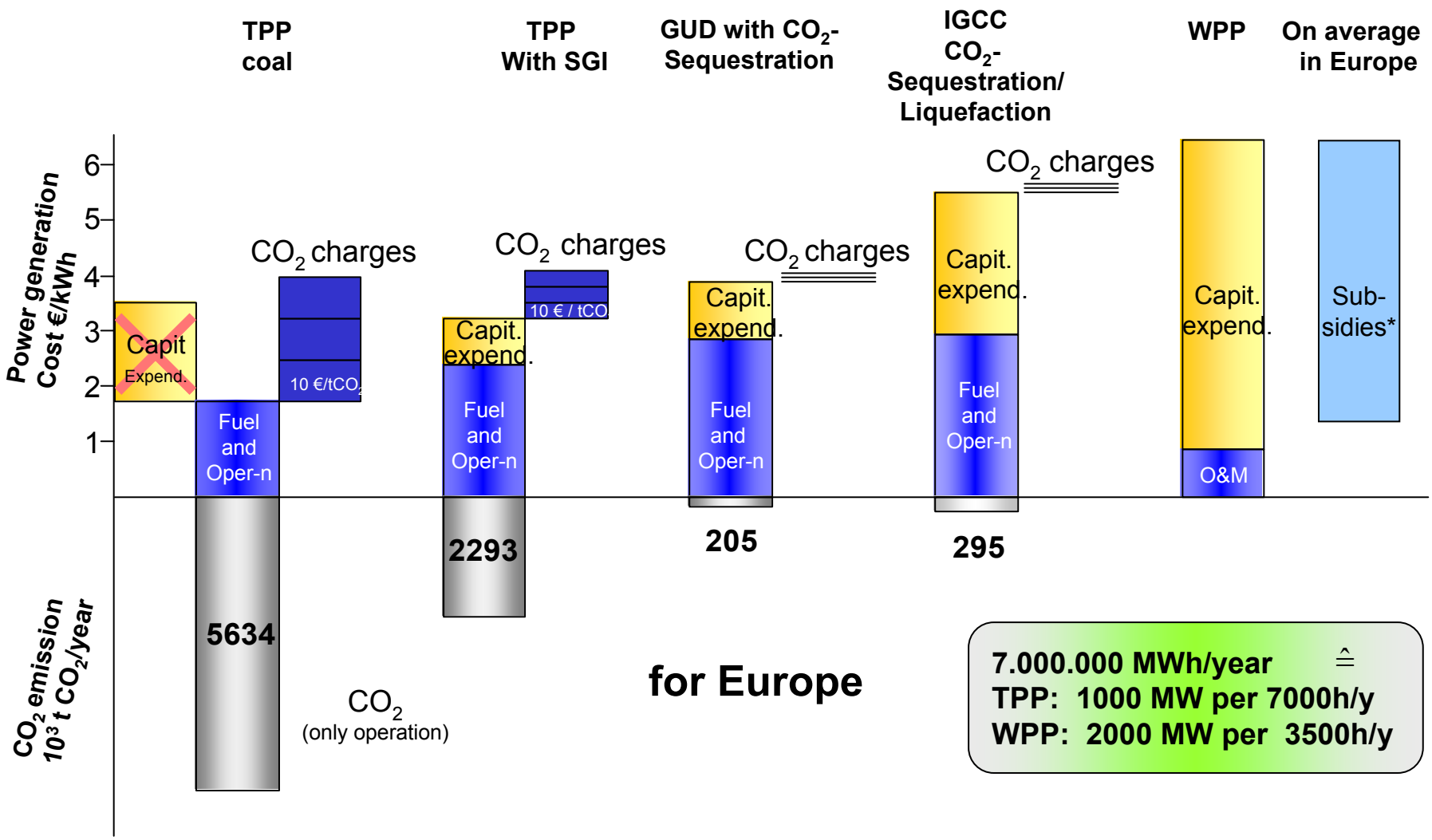


Efficiency factor at the best TPP reaches today 48,6%

CO_2 Emission and Methods of Emission Reduction at Different Types of Power Plants

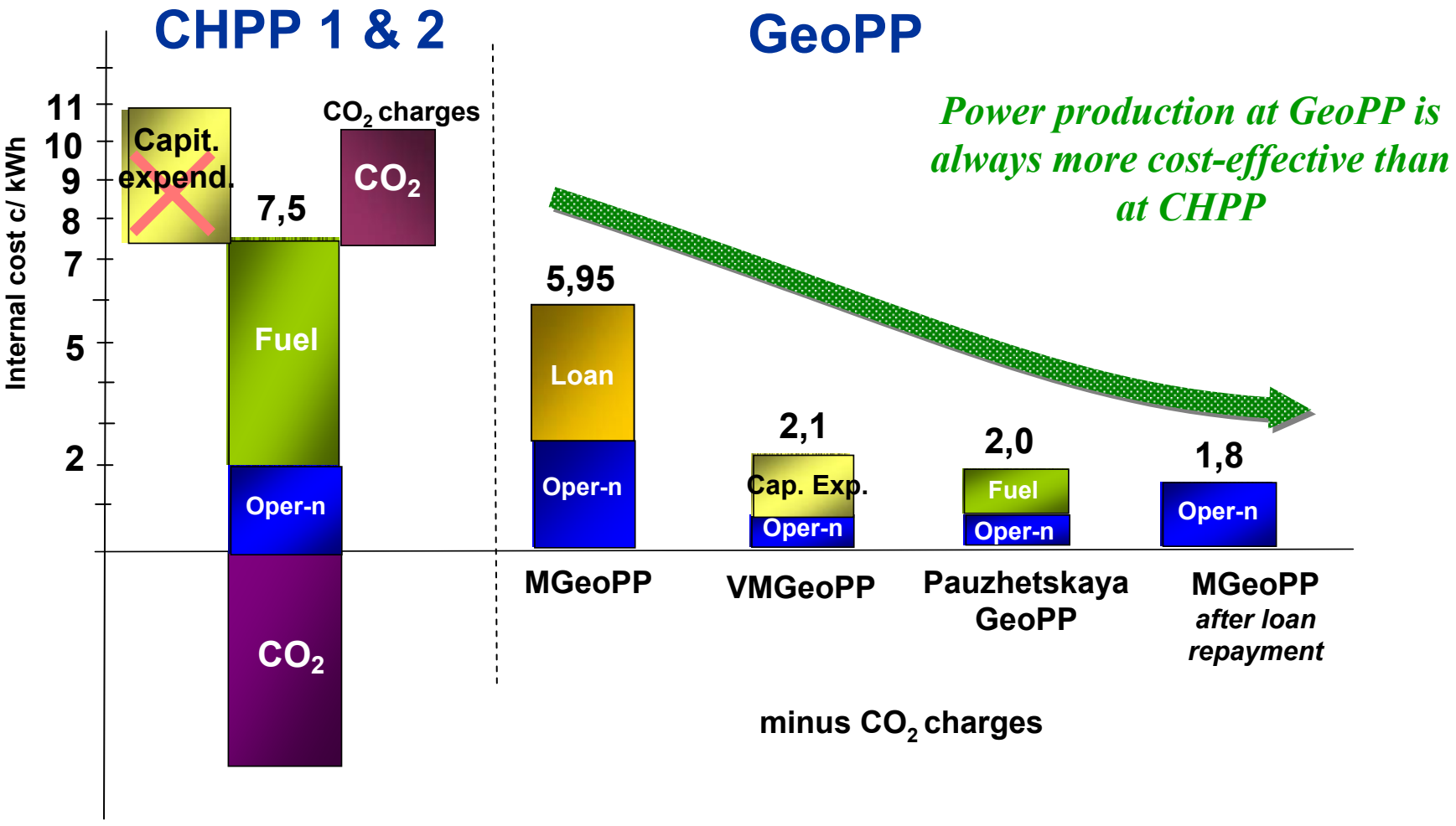


Methods of CO_2 Emission Reduction – Taxation and Subsidies

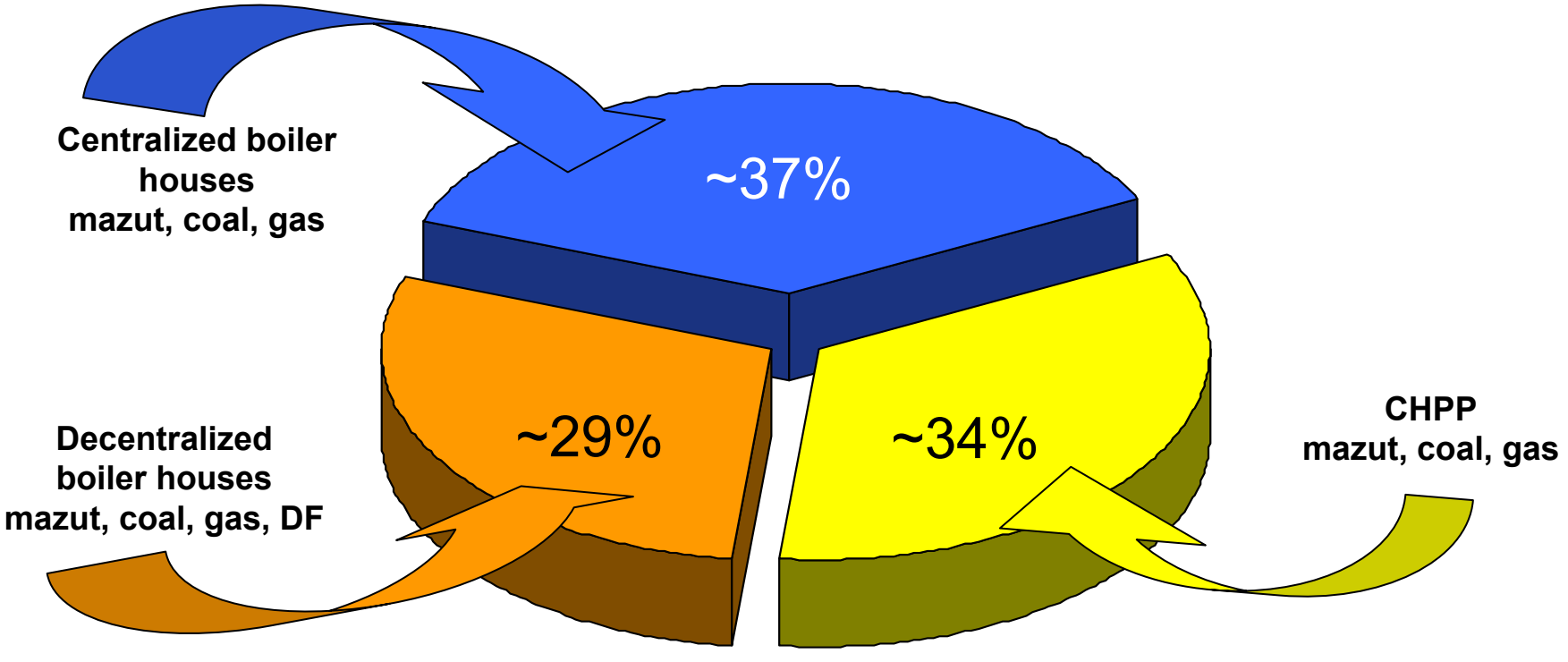


While calculating CO_2 charges per 1 ton were taken at USD 11.0

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

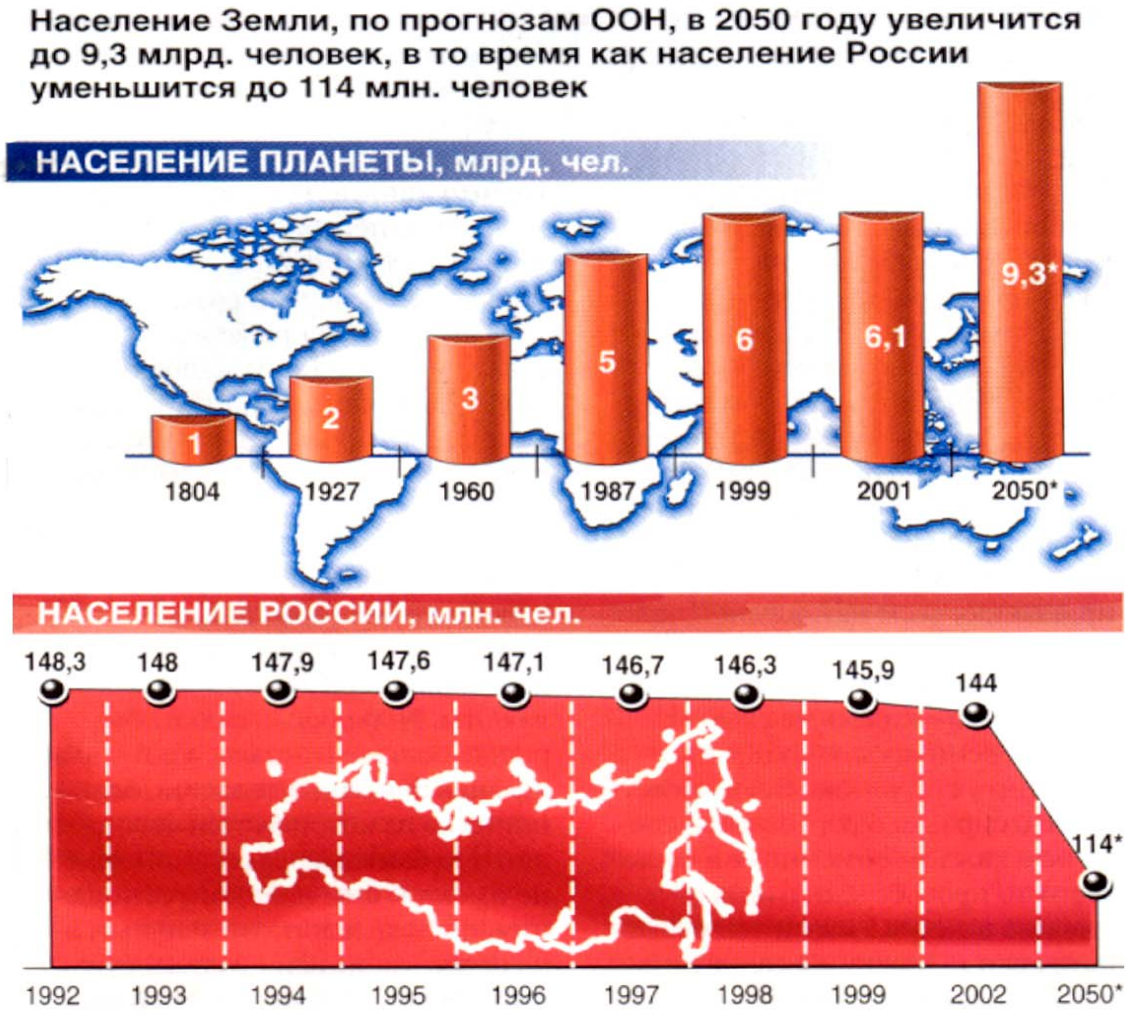


In Russia more that 45% of all consumed energy resources are used for heat supply

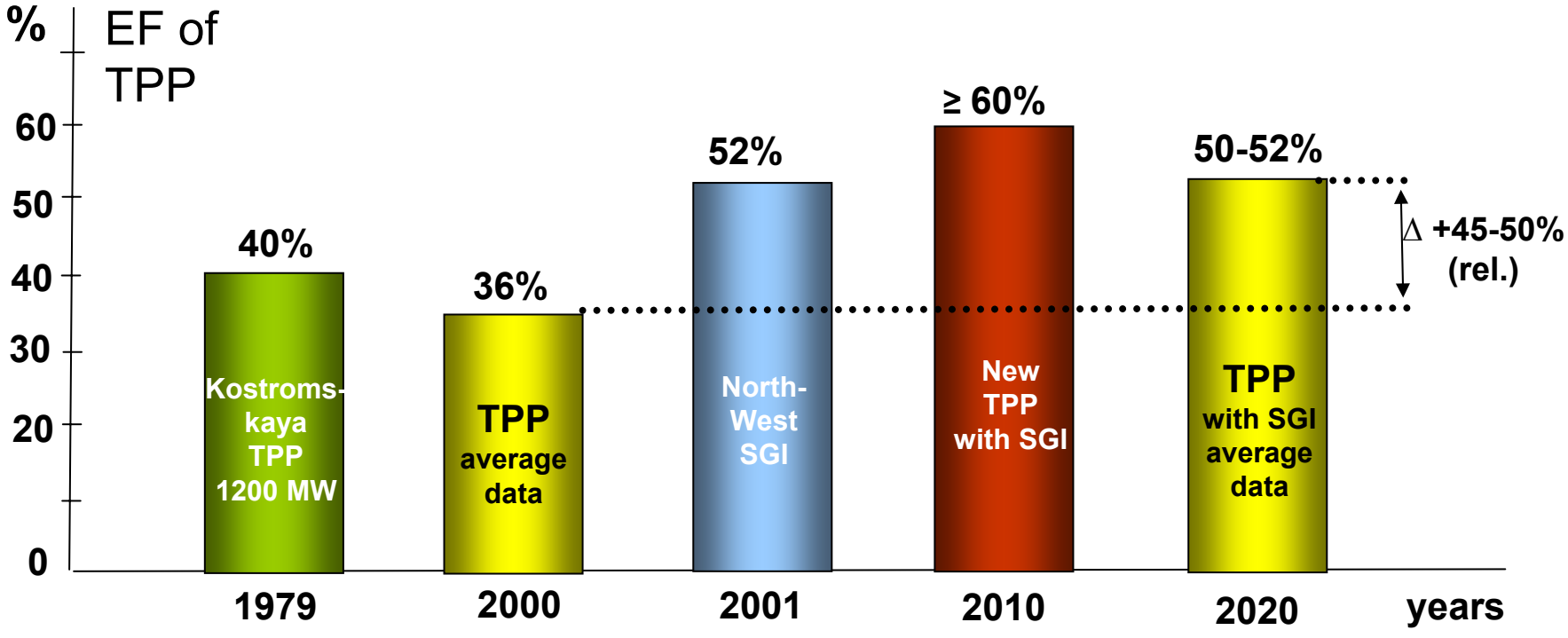


In Russia 50-60% of fossil energy resources utilized for heat supply can be replaced by environmentally friendly and more cost-effective heat of the Earth

World Population



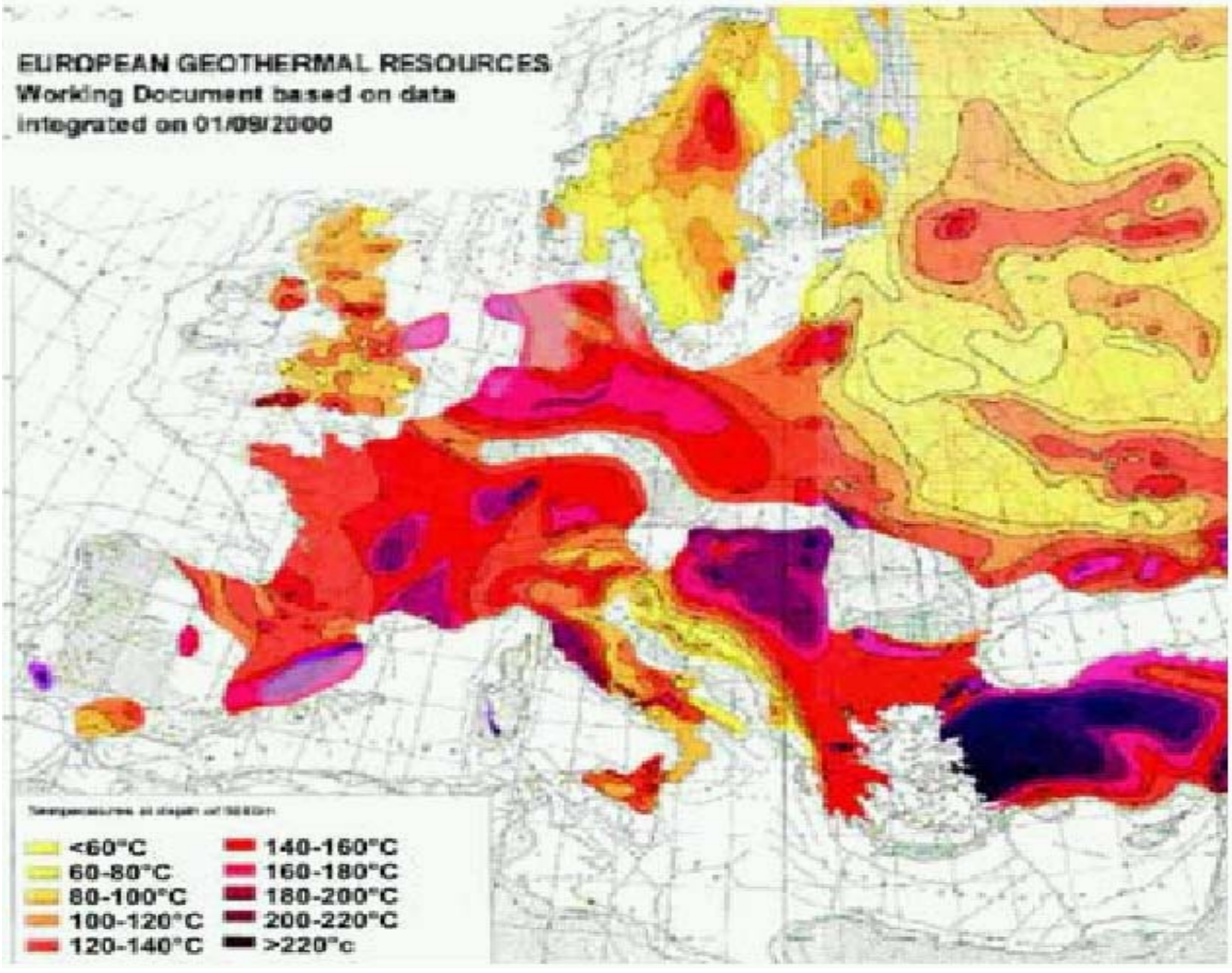
In Russia efficiency factor (EF) of TPP will increase by 45-50% (relative) to 50-52% over the next 15-20 years



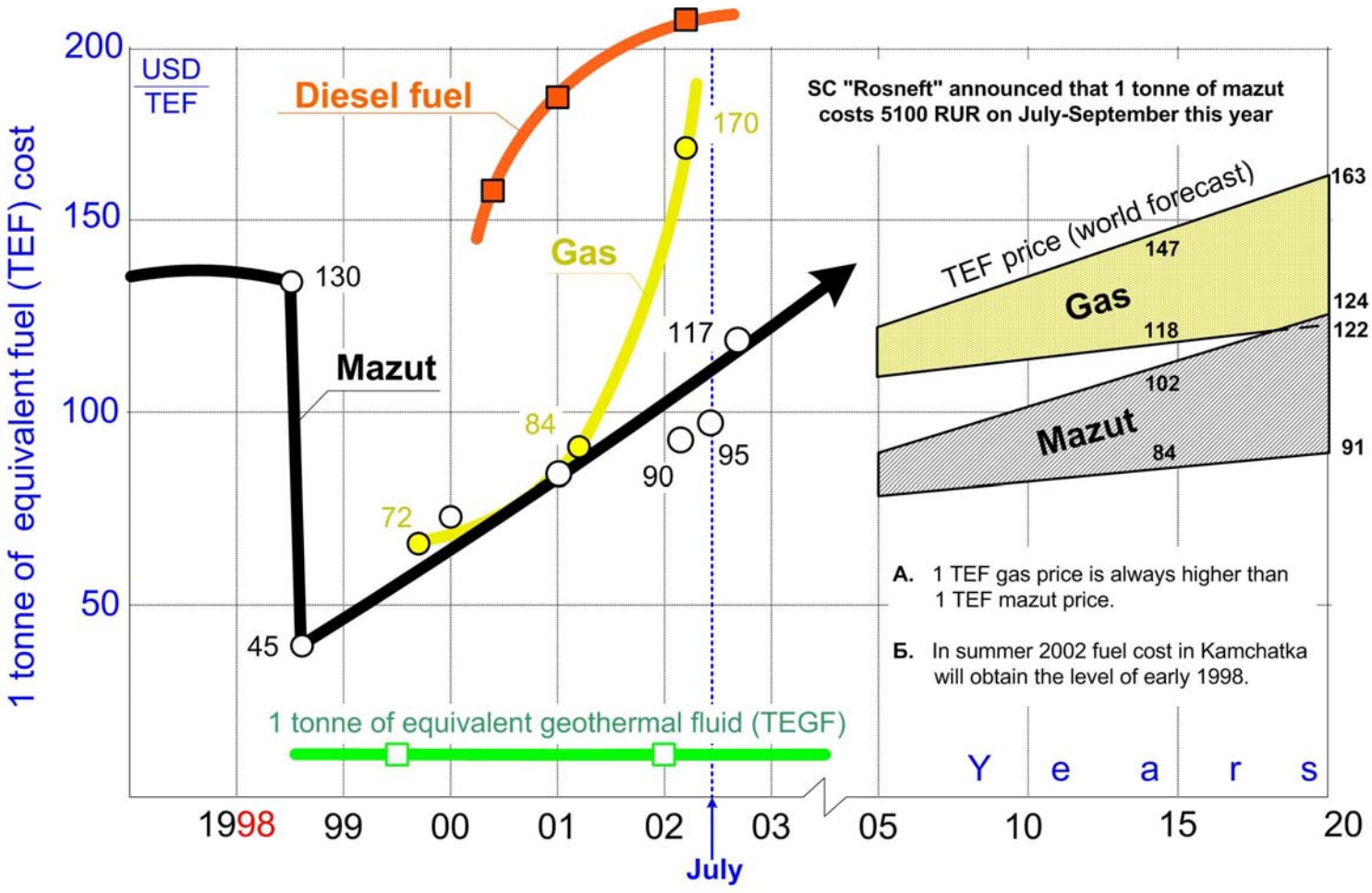
Specific greenhouse gas emission will decrease by 60-70%

Geothermal Resources of Russia

Geothermal Resources of Europe



Fuel Cost in Kamchatka

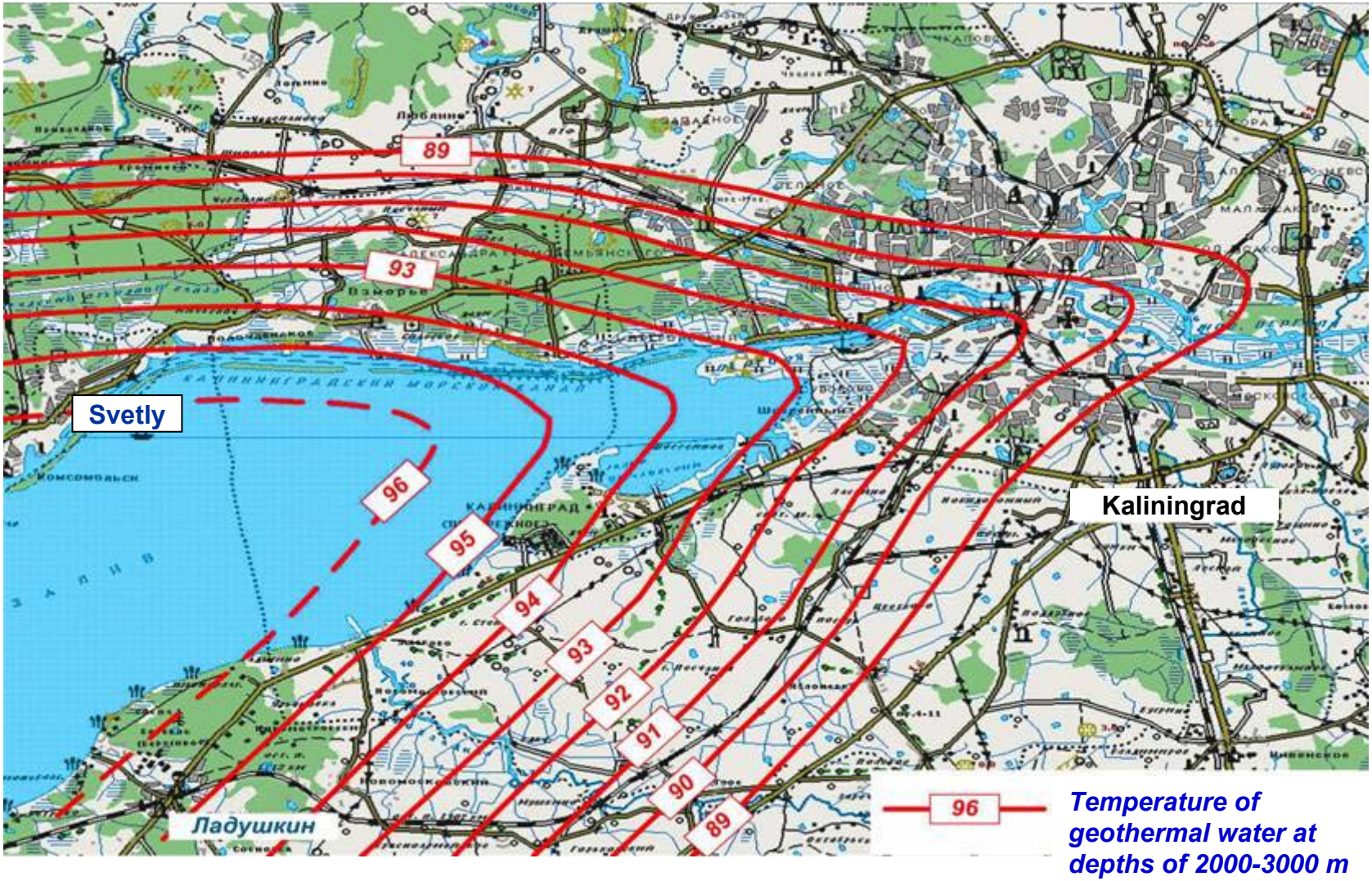


Fuel cost (mazut, diesel fuel, natural gas and geothermal fluid) in Kamchatka within time

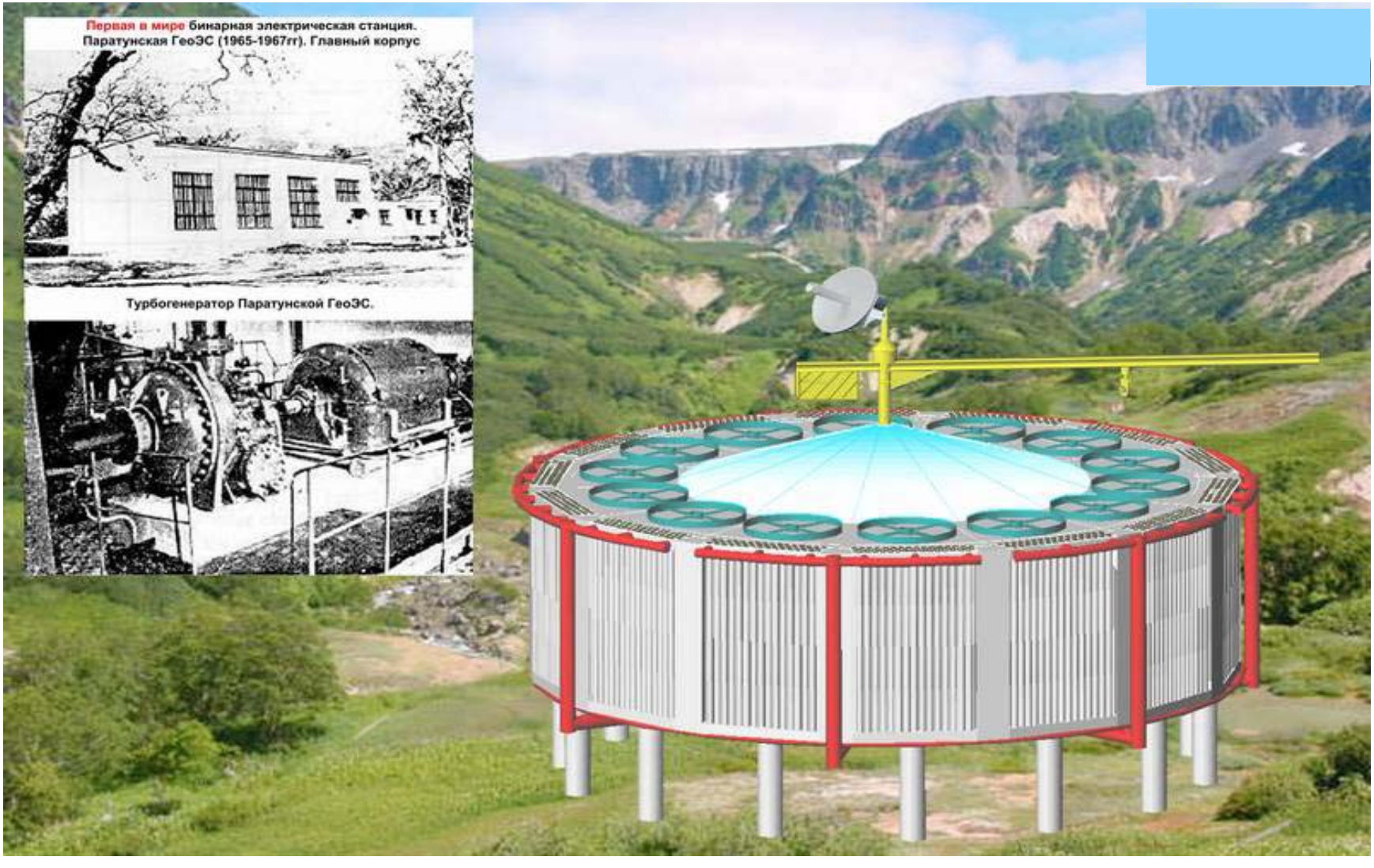
Environmentally friendly Verkhne-Mutnovsky GeoPP (is in operation since 1999)

50 (2X25) MW Mutnovsky GeoPP

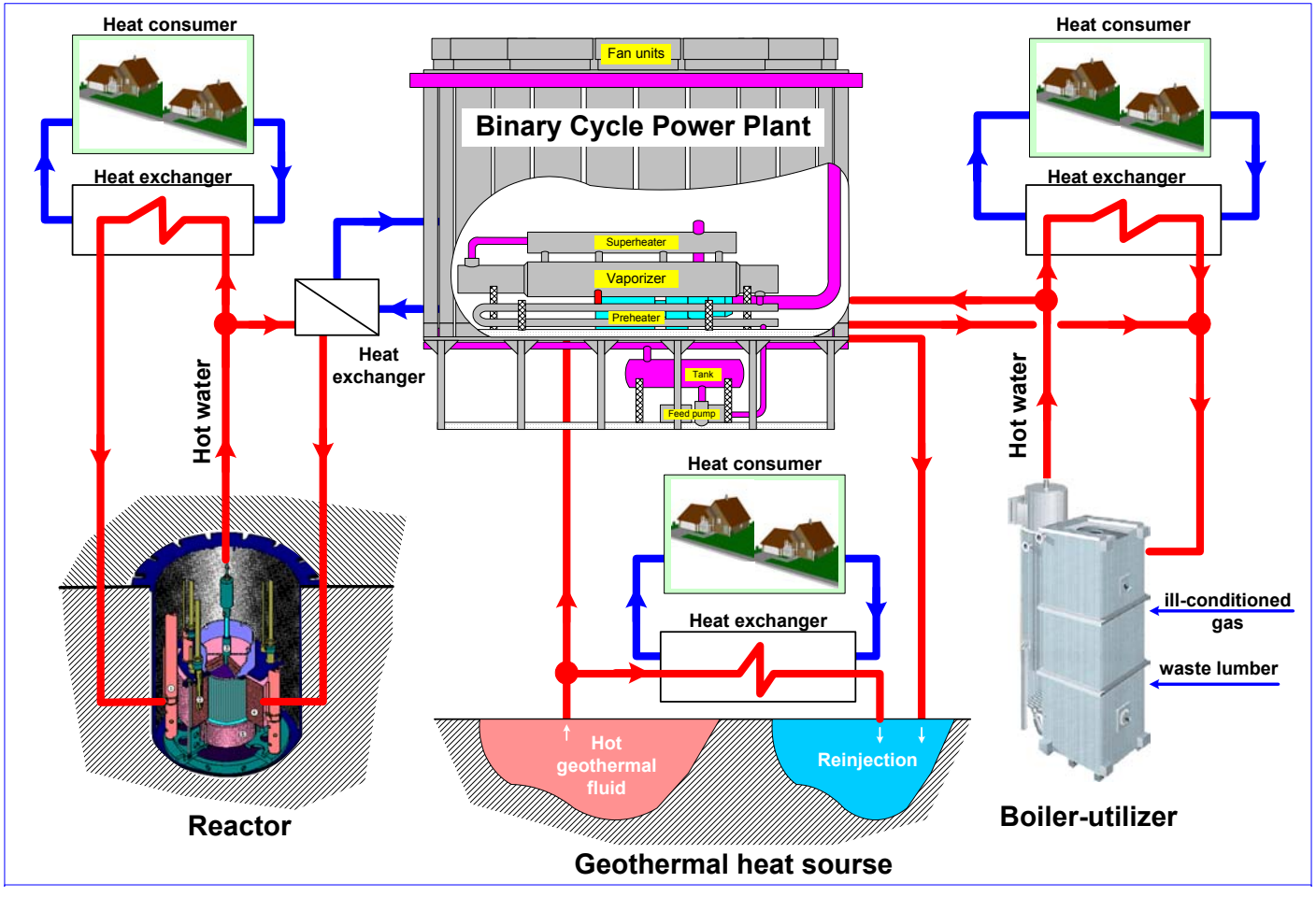
Geothermal Water Temperature Distribution in Kaliningrad Region



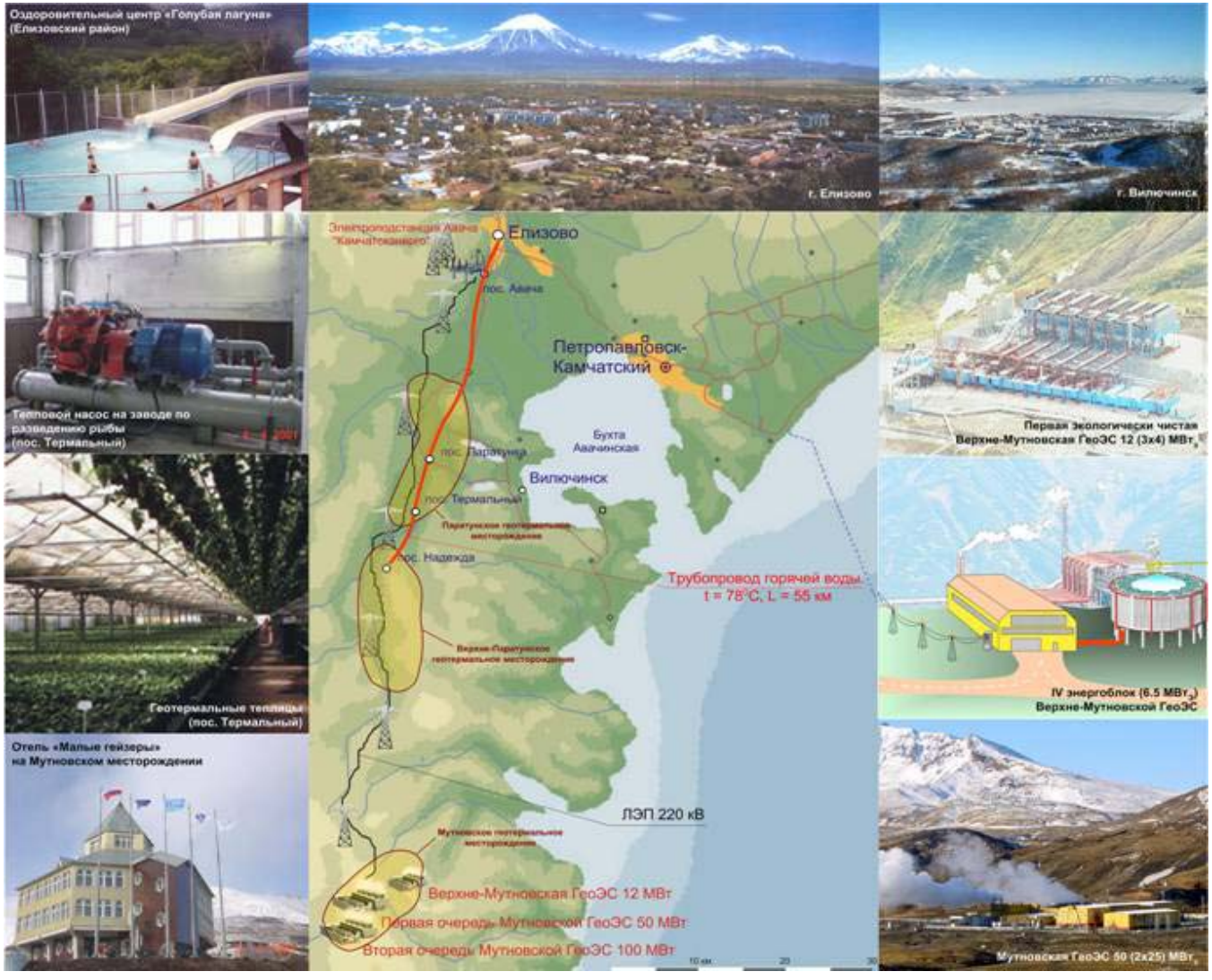
Automated 1-12 MW Binary Power Plant



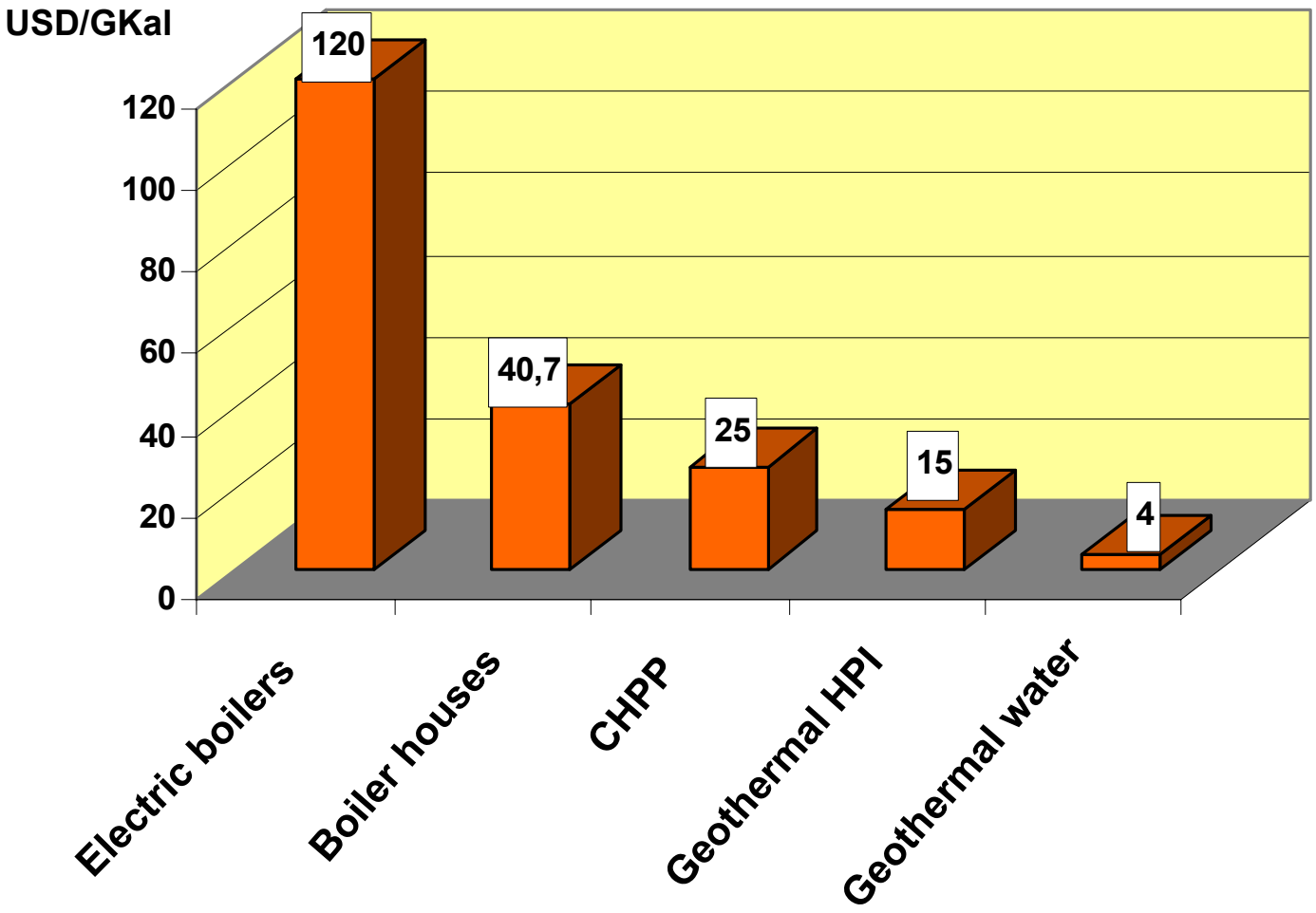
BPP in the System of Local Heat and Power Supply



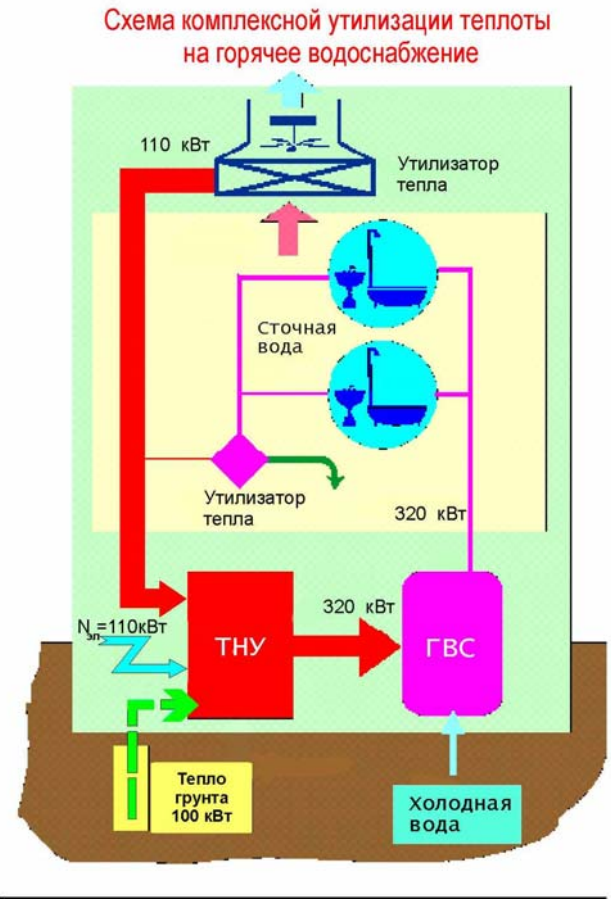
Centers of Geothermal Heat Utilization in Elizovo Region



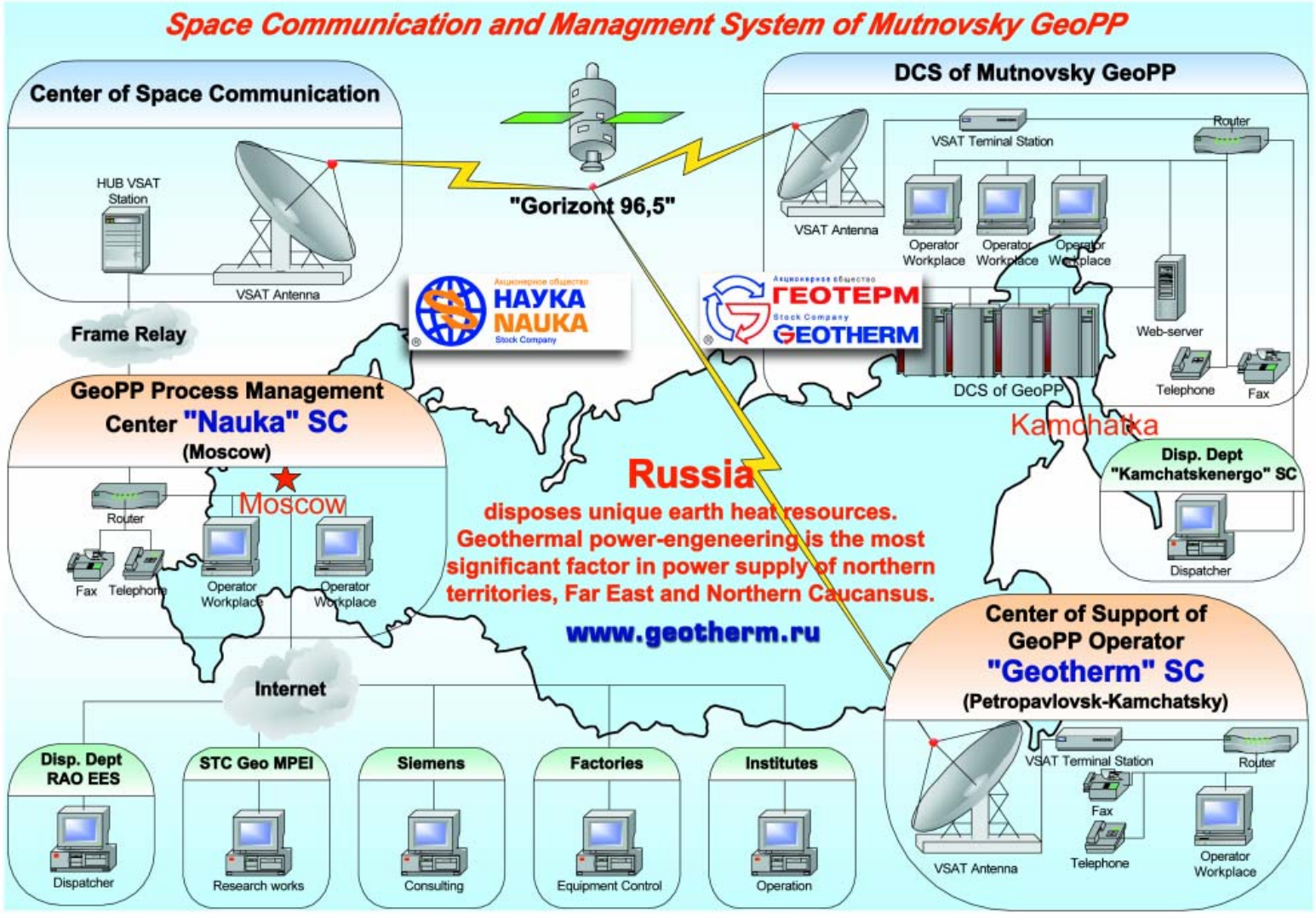
Cost of 1 GKal of Heat in Kamchatka



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



GeoPP Satellite Control System



New Geothermal Projects in Russia