

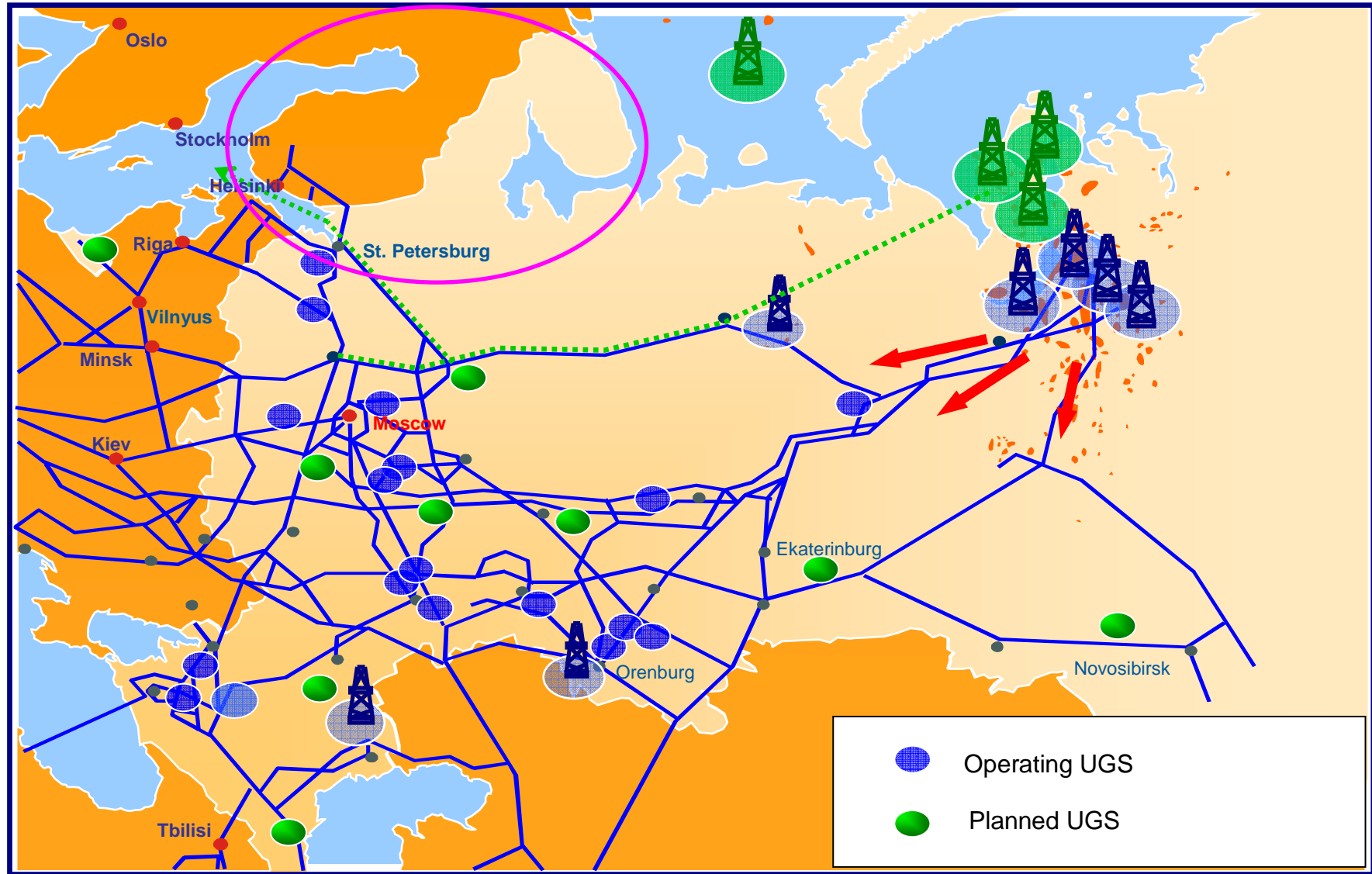


# The alternative to UGS gas storage technologies – ways of implementation

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# UGS system in Russia and region demanding alternative storage



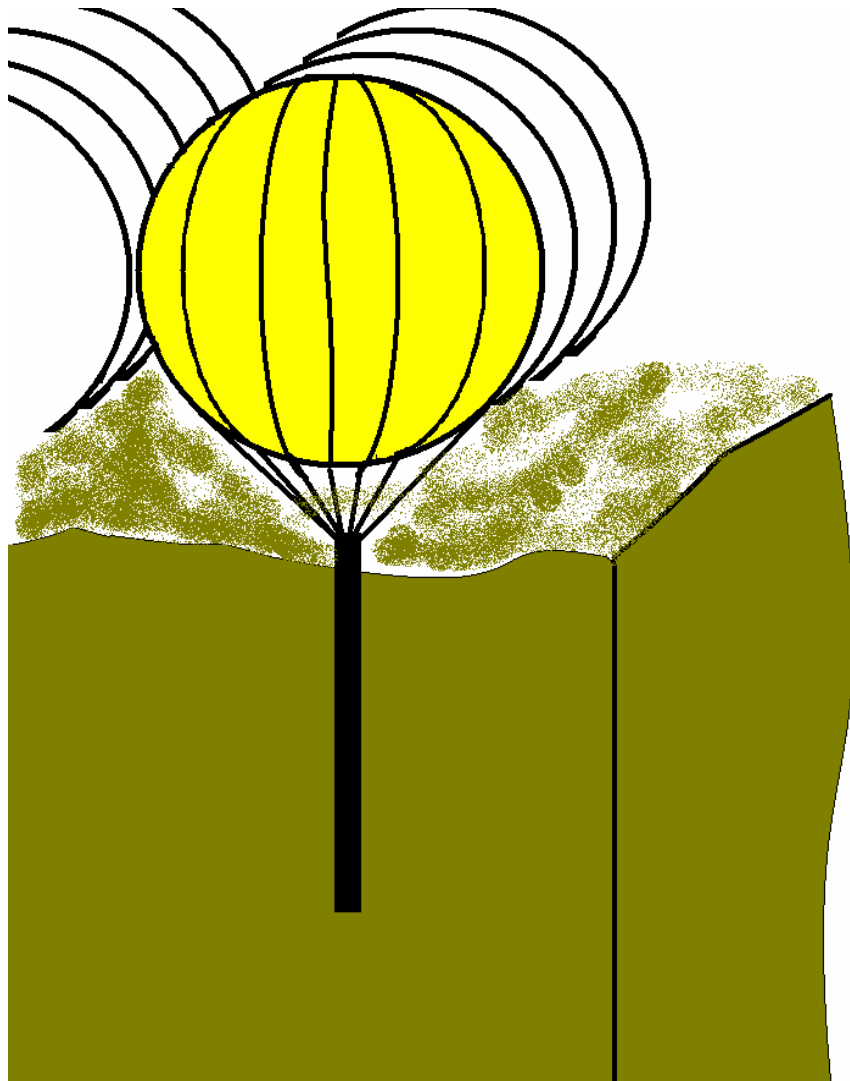
# Gas state in situation of alternative storage

Position	Maximum storage pressure		
	1-20 bar	20-75 bar	75-250 bar
Overhead	Free	-	-
Surface	Gas hydrate	Free, gas hydrate	Free
Floating	Gas hydrate	Free, gas hydrate	Free
Underwater	-	Free, gas hydrate (with depths over 300 m)	Gas hydrate (with depths over 300 m)

# Possible options of alternative storages in the region

1. Surface and floating storages of medium pressure free gas;
2. Surface and floating storage of high pressure free gas;
3. Underwater storage of medium-pressure free gas;
4. Surface and floating storage of low pressure gas hydrate;
5. Surface and floating storage of medium pressure gas hydrate;

# Medium pressure underwater storage



## Parameters:

Water depth – 30-50 m

Dimensions - 800x840 m

Number of spheres – 1670

Material – kapron-based rubber fabric (42 layers)

Working pressure – from 1 to 75 bar

# Low pressure gas hydrate storage (metastable hydrates)

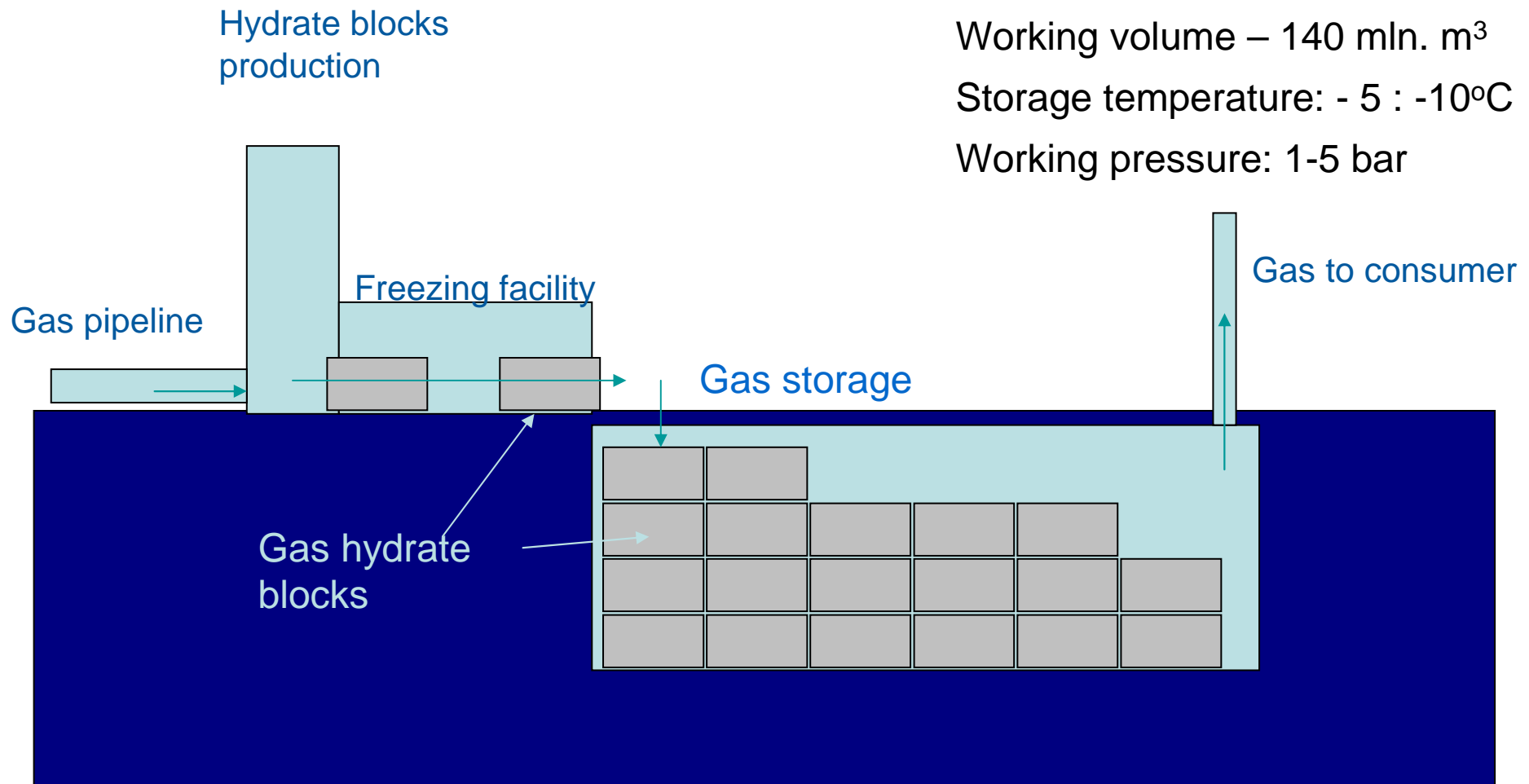
## Parameters:

Dimensions – 250x200x25 m

Working volume – 140 mln. m<sup>3</sup>

Storage temperature: - 5 : -10°C

Working pressure: 1-5 bar



# Rating of alternative storage

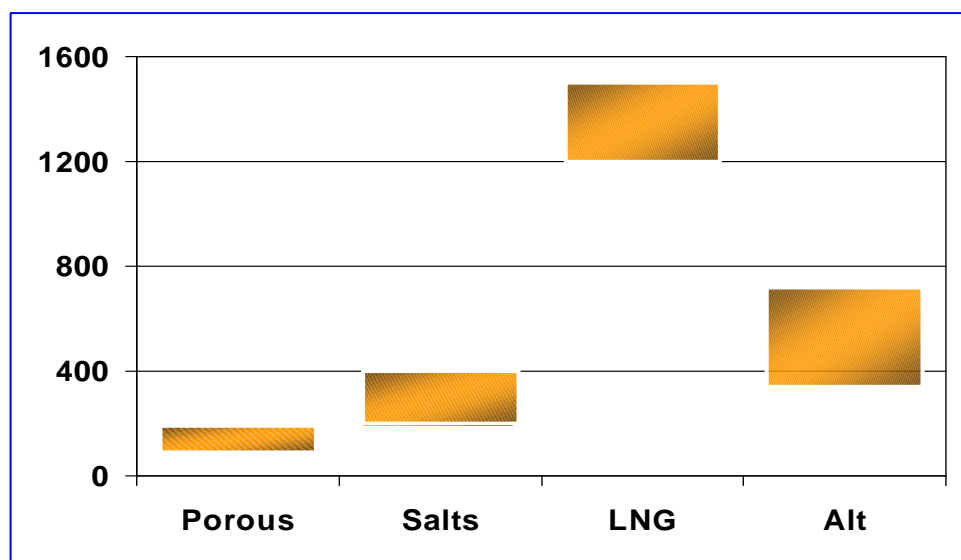
	Peak shaving storage* CAPEX, mln. USD	Degree assessment	Rating
<i>Free gas storage</i>			
Medium pressure surface and floating	550 - 650	88	V
High pressure surface and floating	200 - 250	100	III
Medium pressure underwater	100 - 130	110	II
<i>Gas hydrate storage</i>			
Low pressure surface and floating	40 - 50	113	I
High pressure surface and floating	400 - 500	96	IV

\* - working volume  $140 \cdot 10^6 \text{ m}^3$

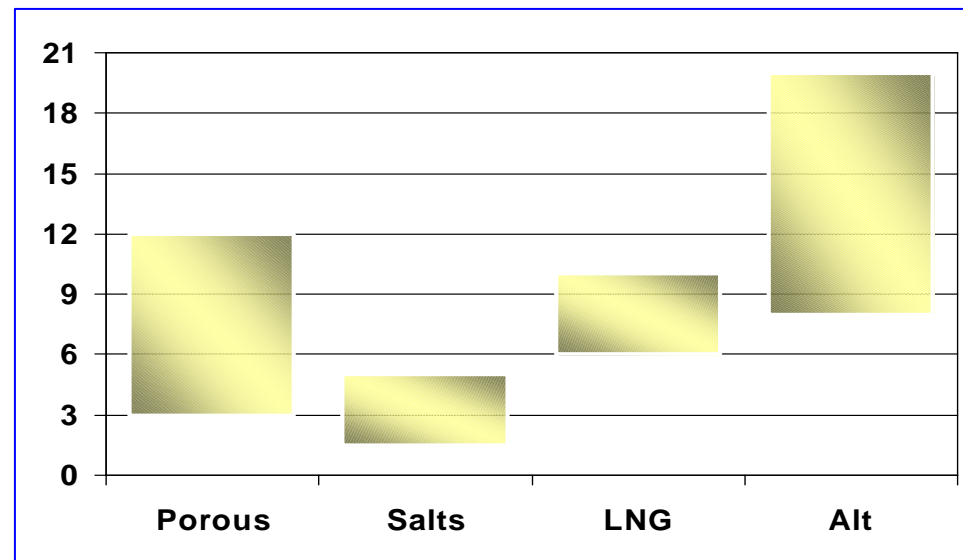
# Conclusion

- Gas storages on the basis of alternative technologies with economical indices compatible with conventional underground storage methods can be used for solving of the problems of gas supply security

**\$/1000 m<sup>3</sup> working volume**



**\$/m<sup>3</sup> daily withdrawal**





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