International Energy Agency

Collaborative Project

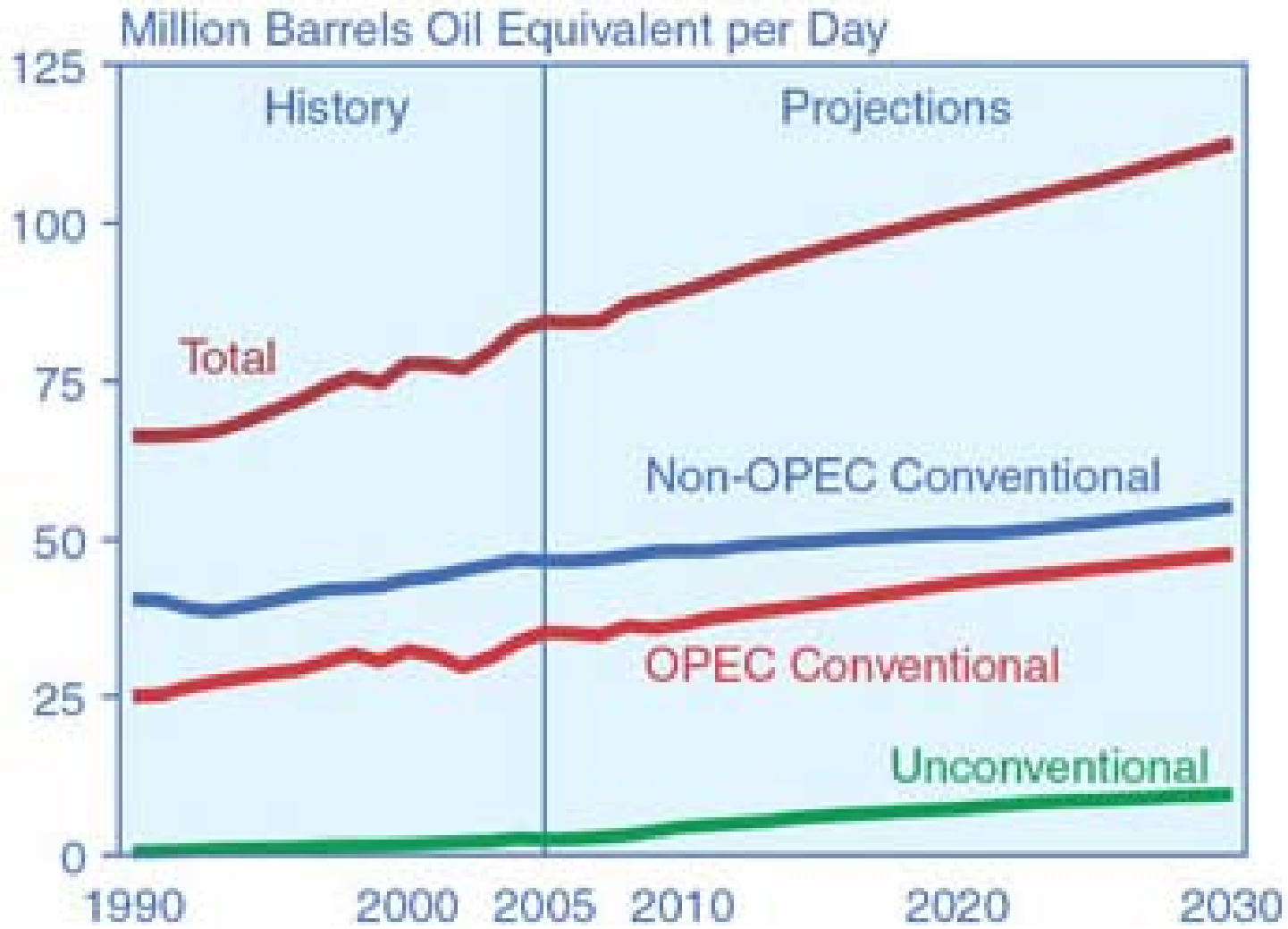
on

Enhanced Oil Recovery

Torsten CLEMENS

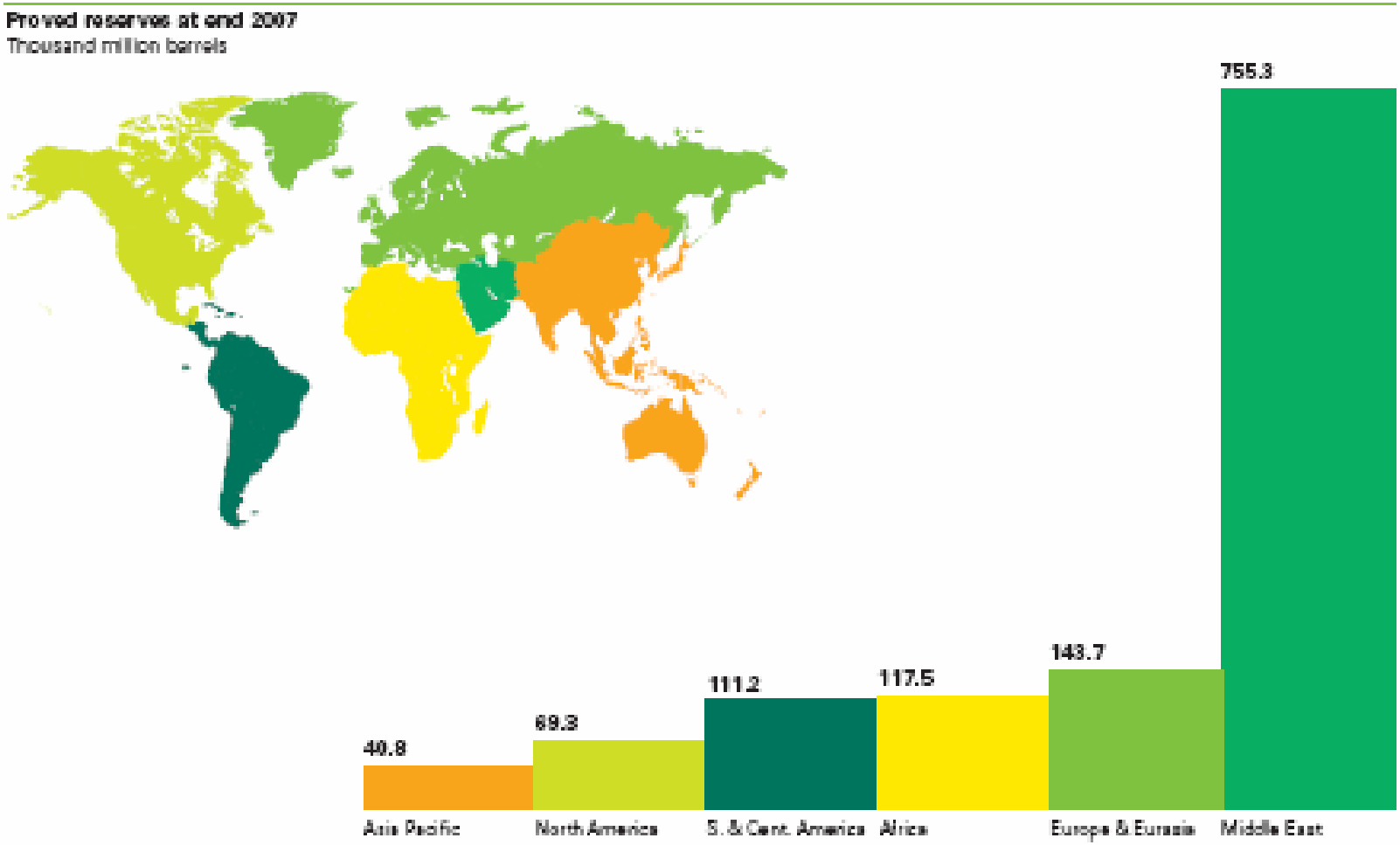
Vienna, Oktober 2008

Oil Production Forecast



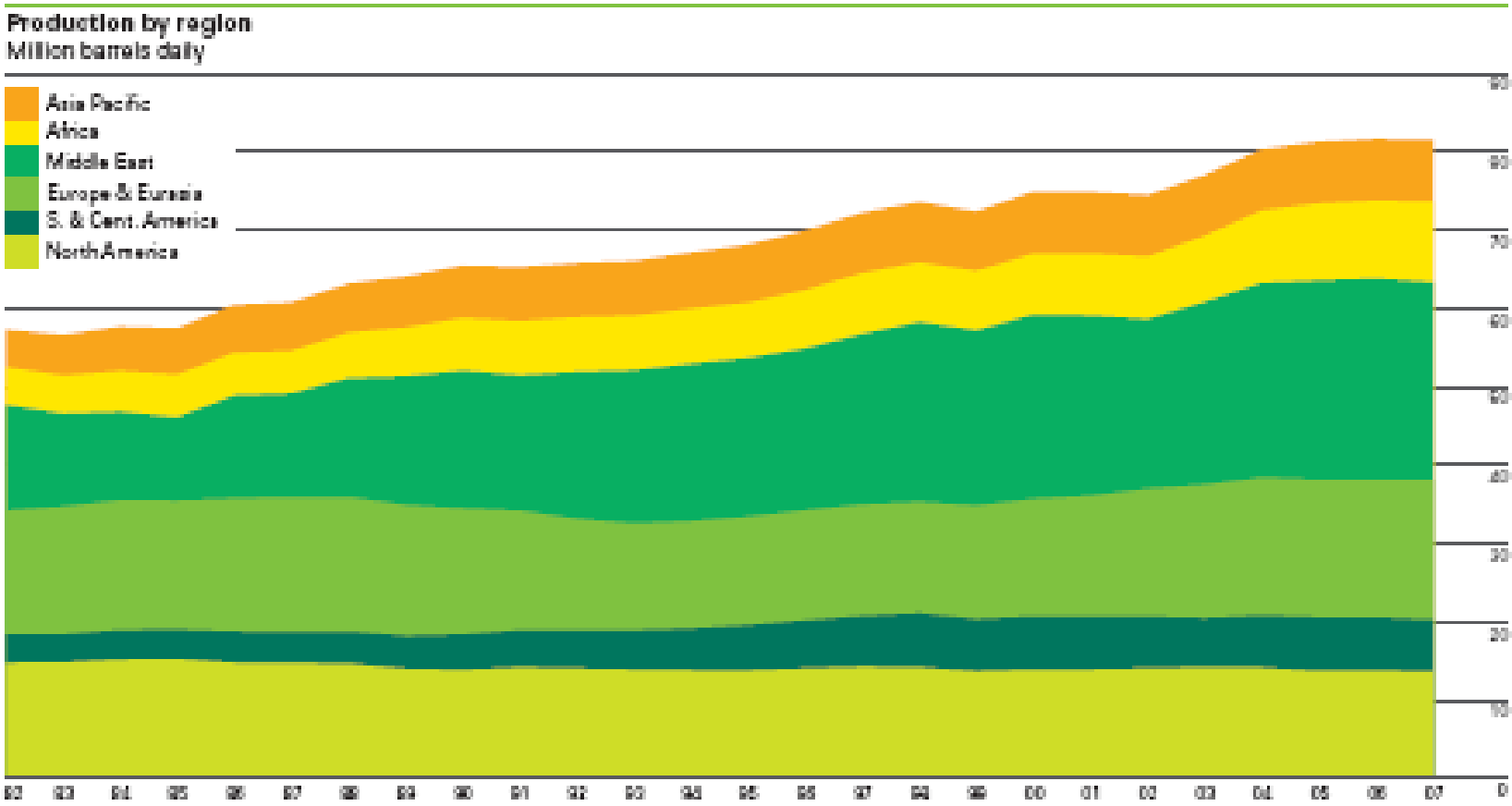
International Engergy Agency

Proved Oil Reserves Distribution



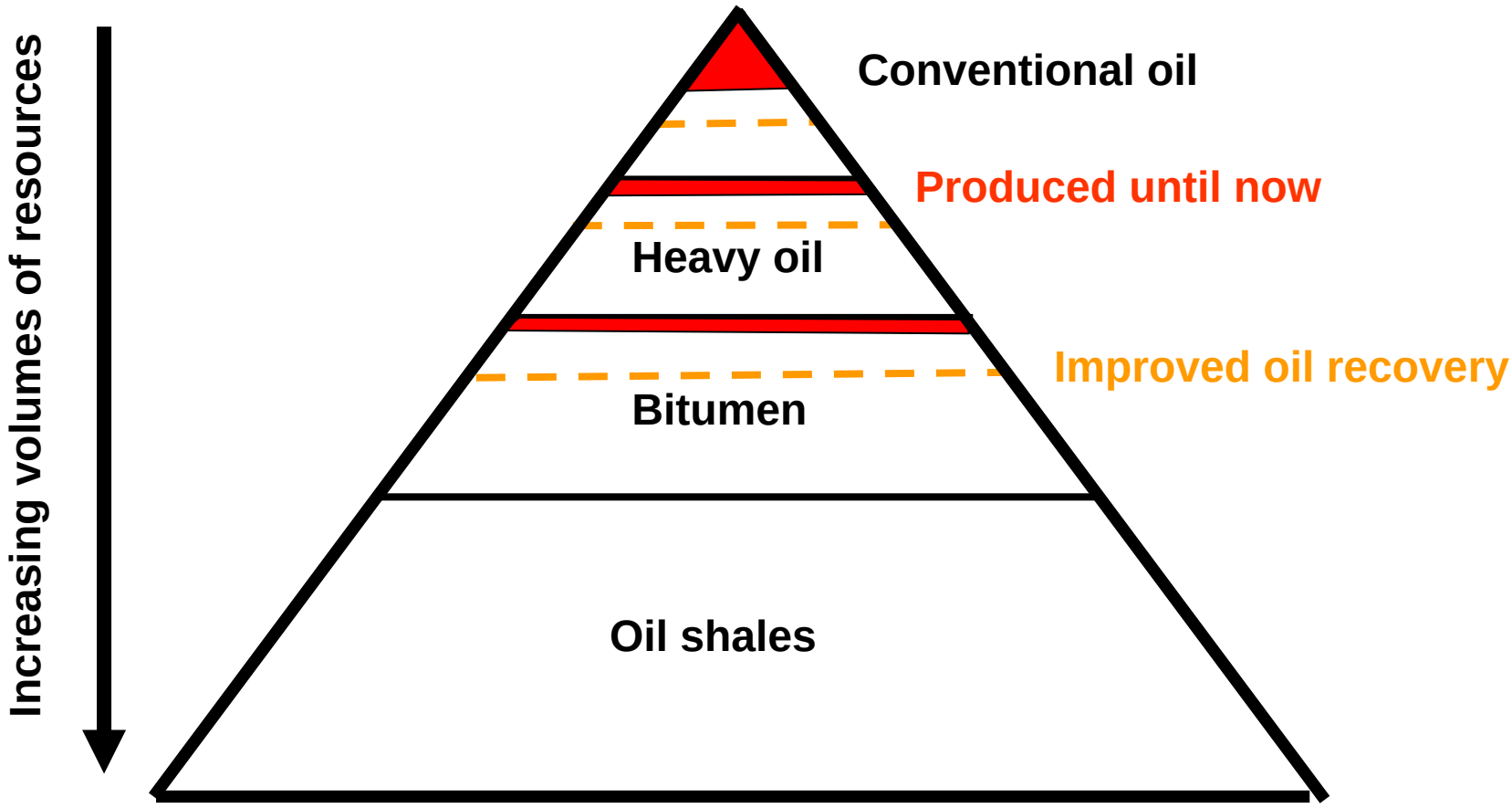
BP Statistical Survey 2008

Oil Production Distribution

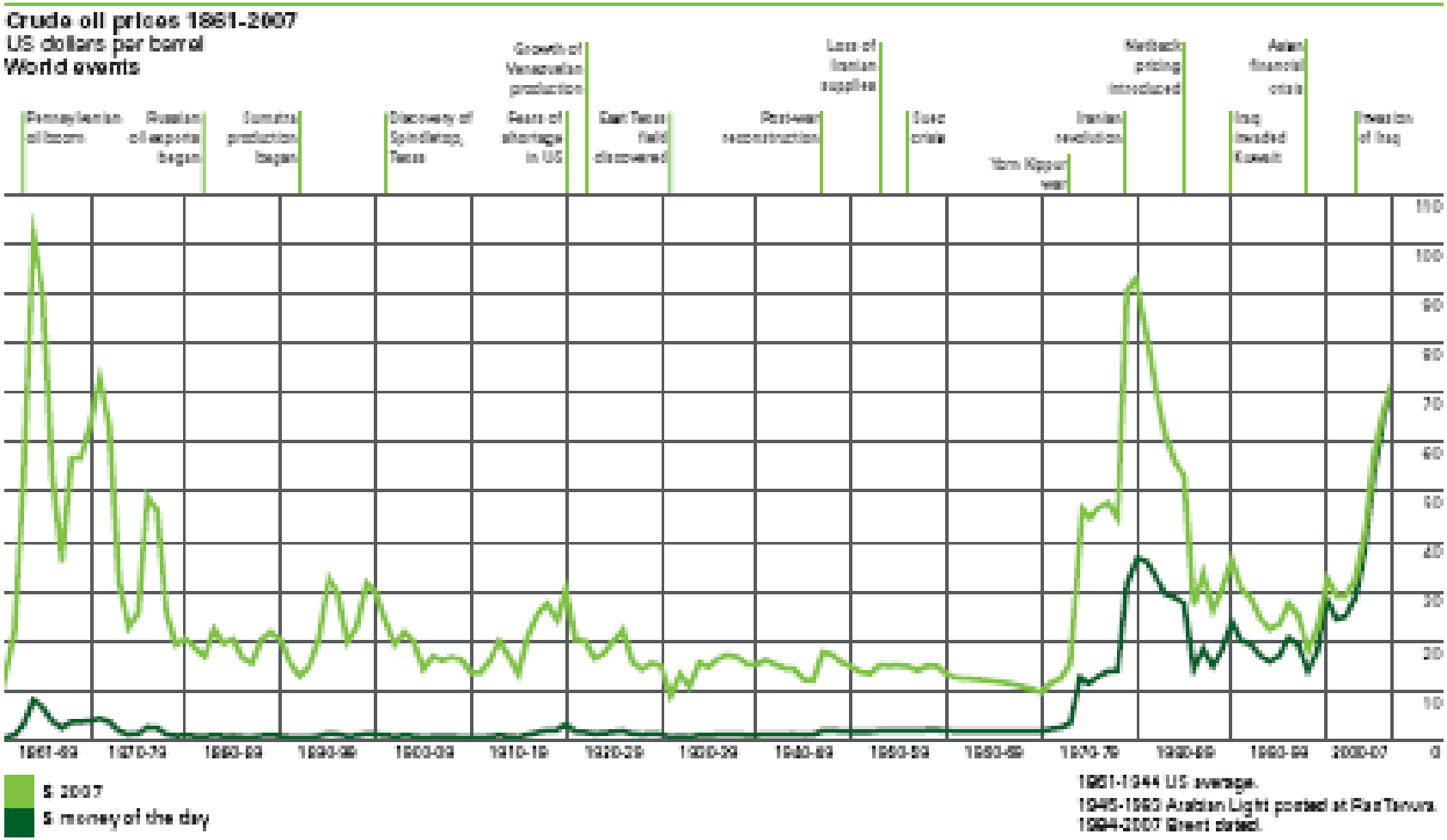


BP Statistical Survey 2008

Resources Triangle

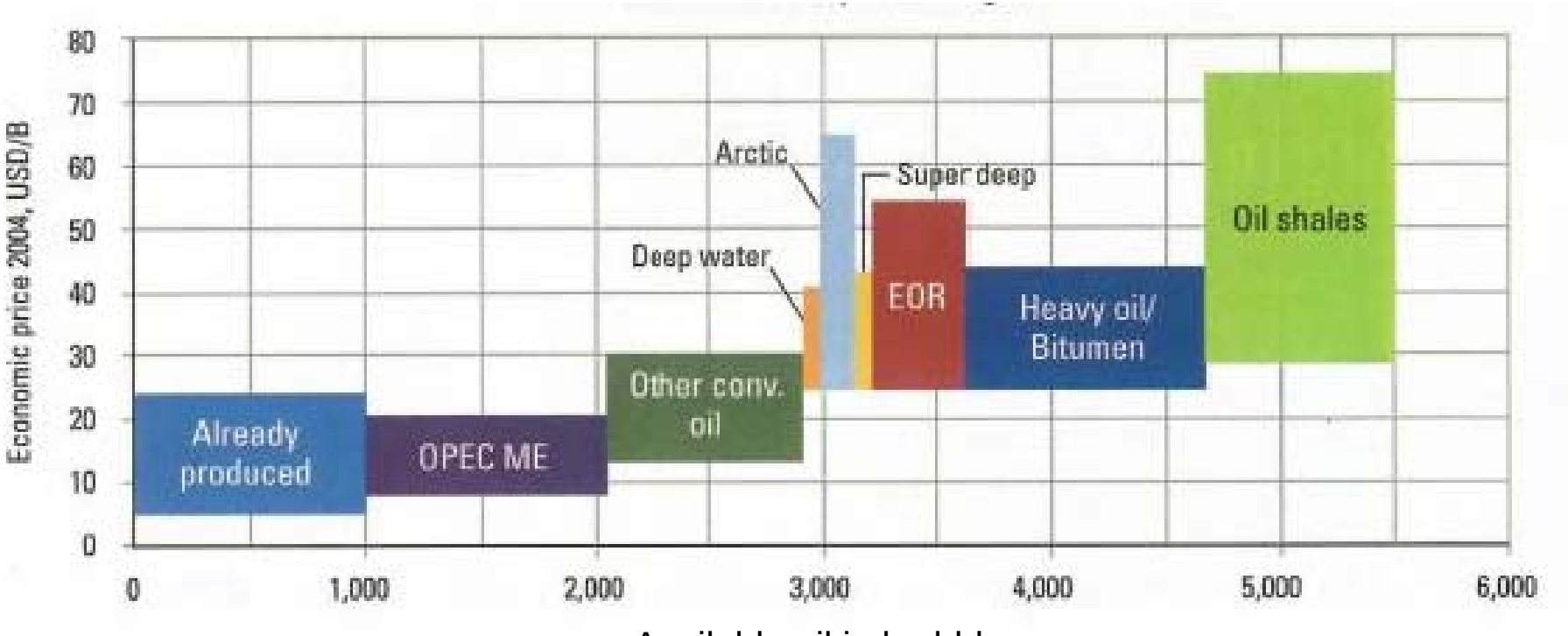


Crude Oil Prices



BP Statistical Survey 2008

Oil production costs



A. Belani, JPT July 2008

IEA Joint Implementing Agreement - commitments to study EOR technologies

TASK	A	B	C	D	E	F	Total
Australia	1		1				2
Austria			2				2
Canada		1	1				2
China		1	1			1	3
Denmark	1	1	2	1	1		6
France	1	1	1	1			4
Japan	1		1		1	1	4
Norway	1	1	1		1	1	5
Russia	1						1
Venezuela*							
United Kingdom	1		1		1	1	4
United States	(**)		(**)	(**)			(**)

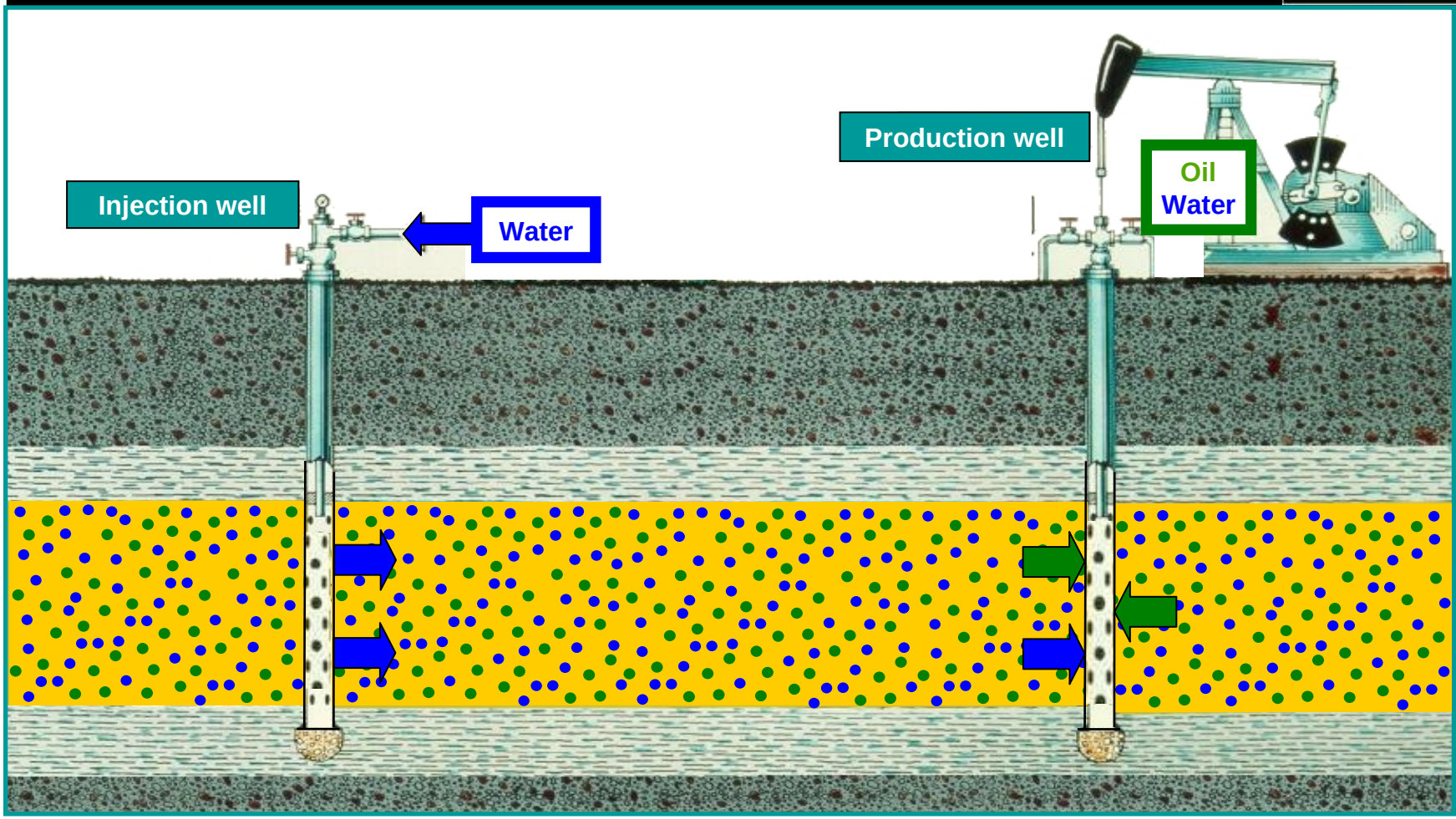
Enhanced Oil Recovery Technologies

good quality oil	viscous oil	very viscous oil
(1 cP)	(100 cP)	(1000 cP)

Technologies to enhance oil production:

Water/Gas injection	Polymer injection	Steam injection
Surfactant injection		In situ combustion
High pressure Air injection		

How much oil remains in the reservoir?



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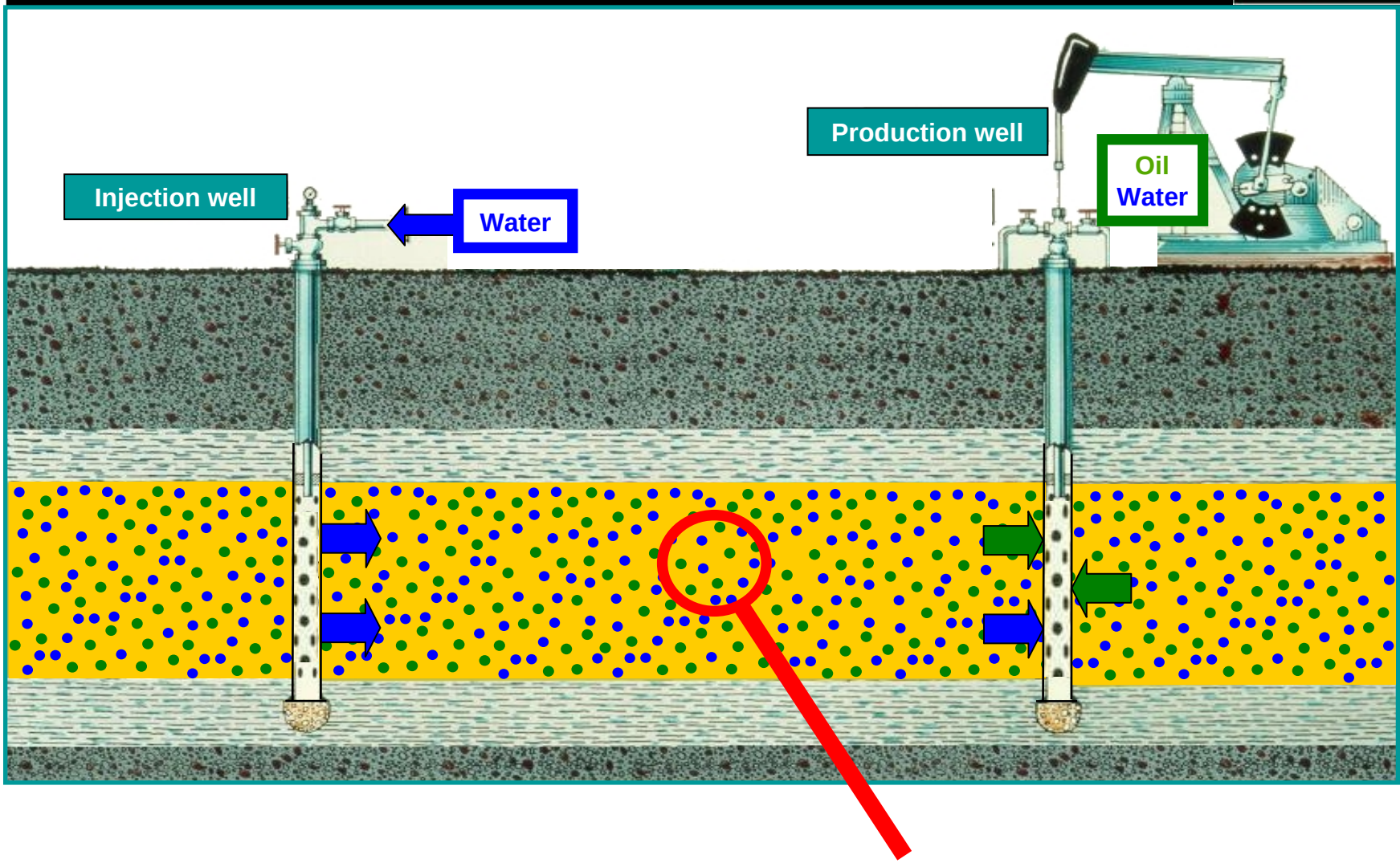
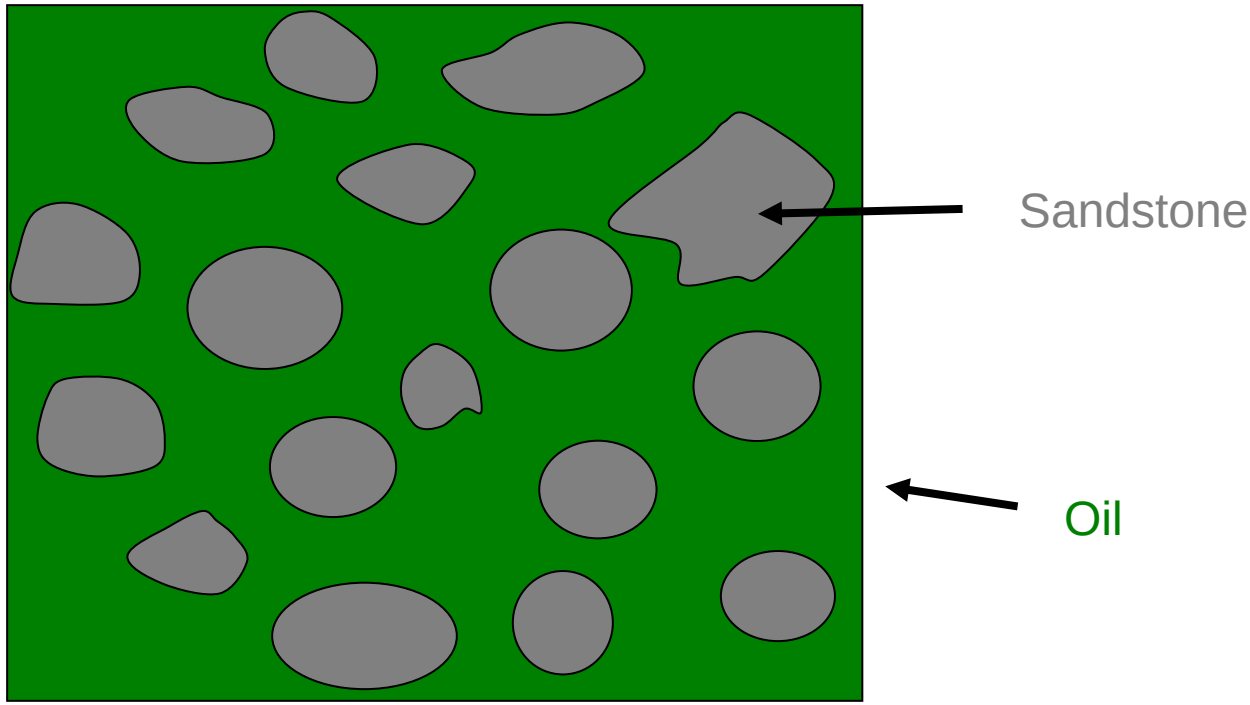


How much oil remains in the reservoir – microscopic level



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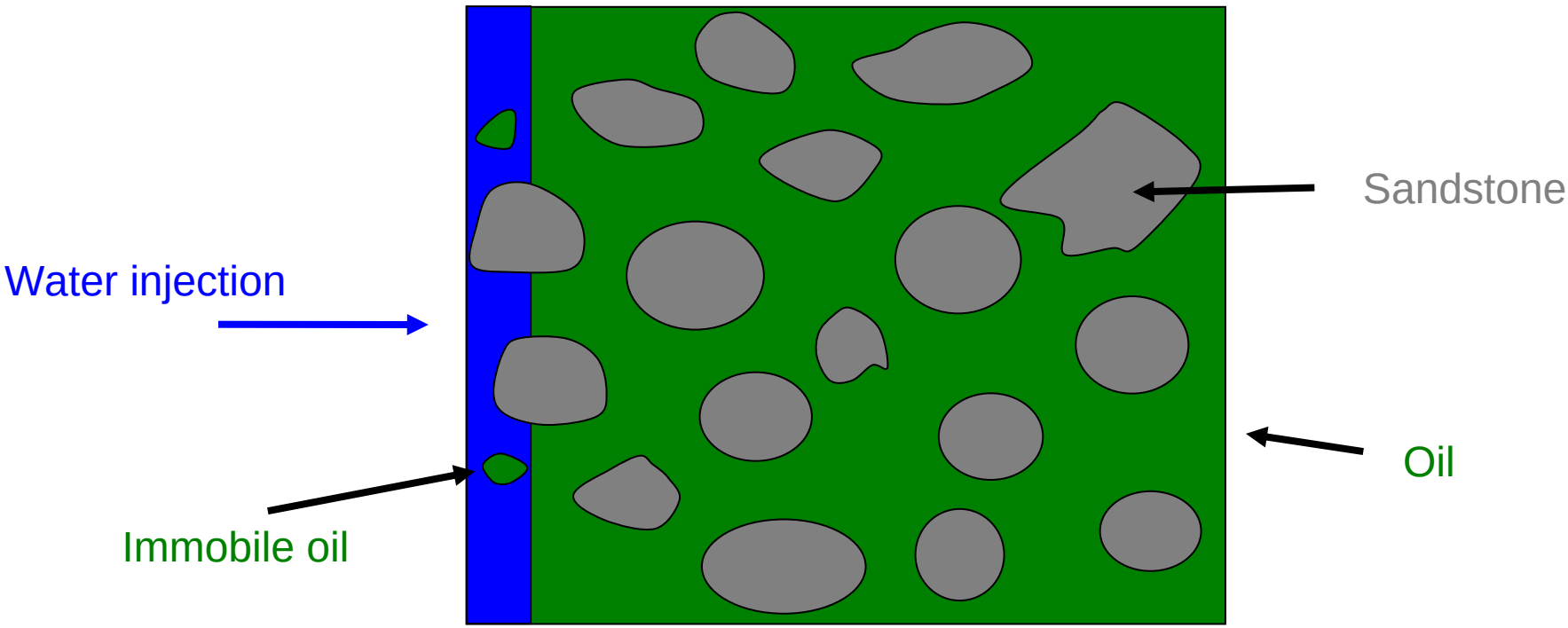

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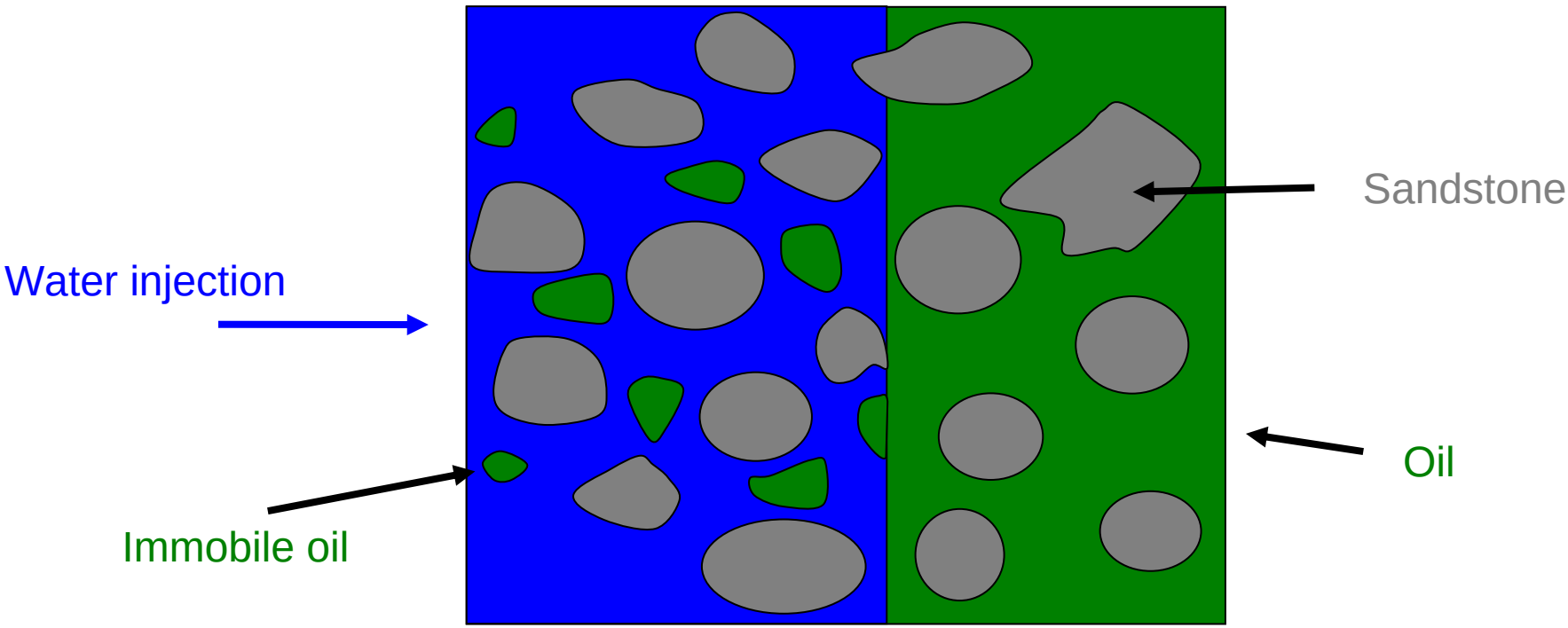

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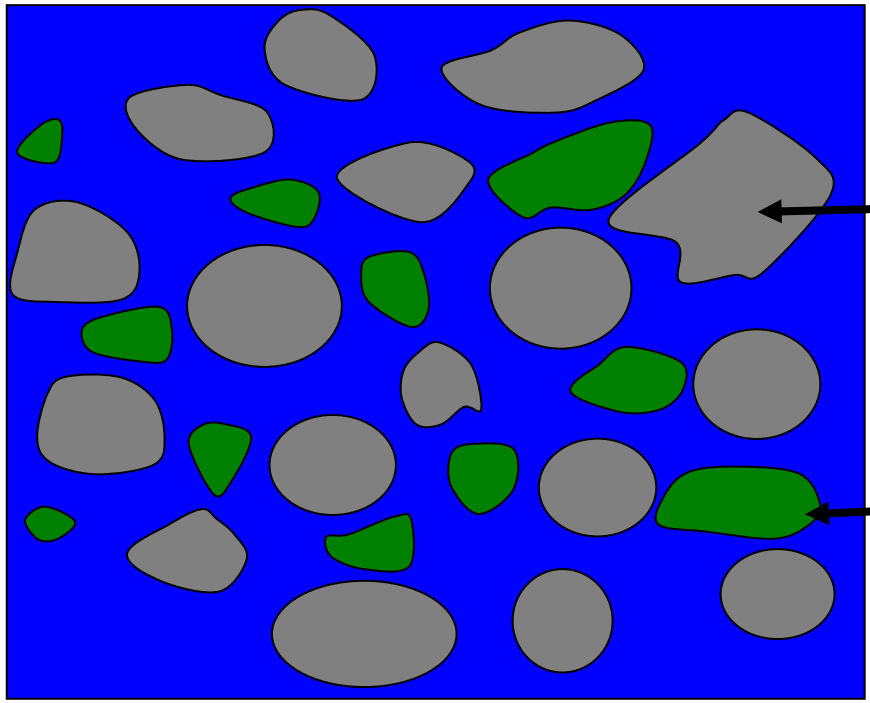


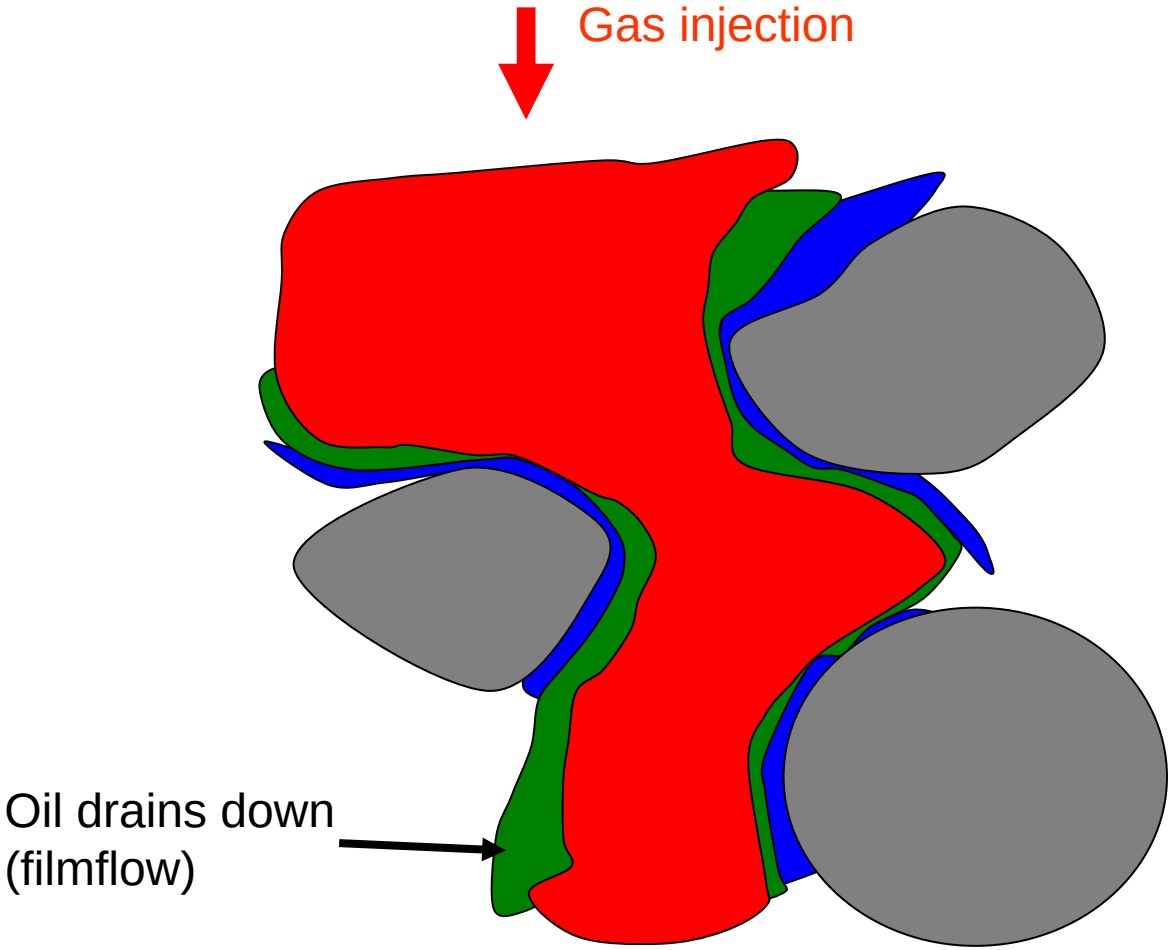
Water injection

Sandstone

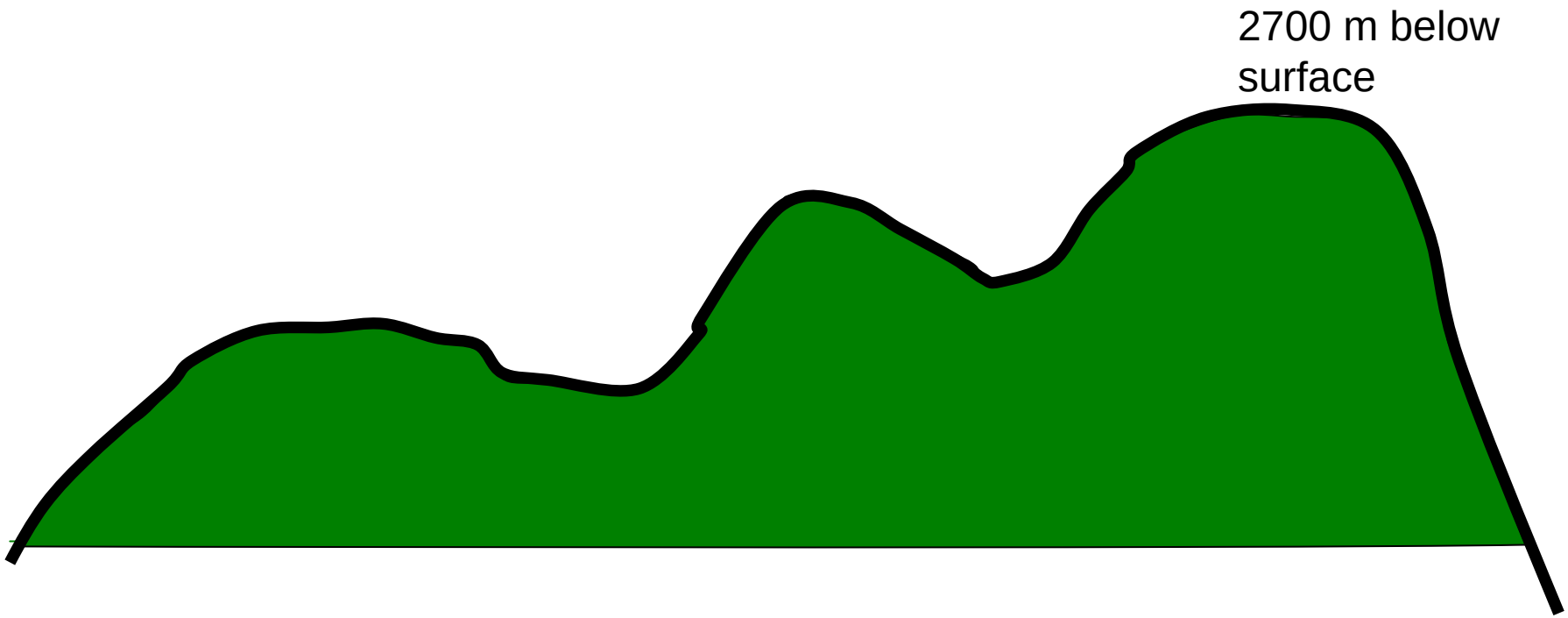
Immobile oil

30 % or even 100 % of the oil cannot be produced!

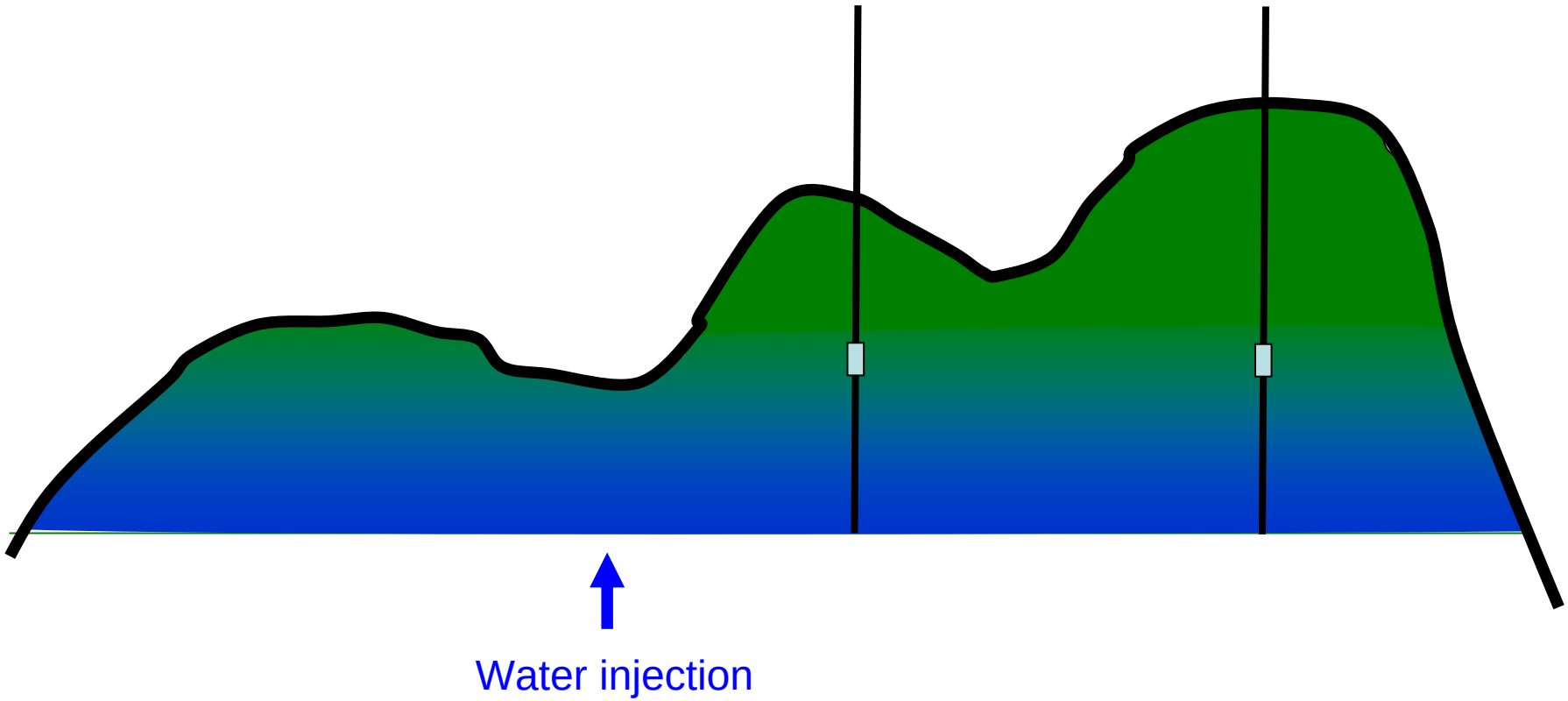
Gas injection for increased recovery



Gas injection example



Gas injection example



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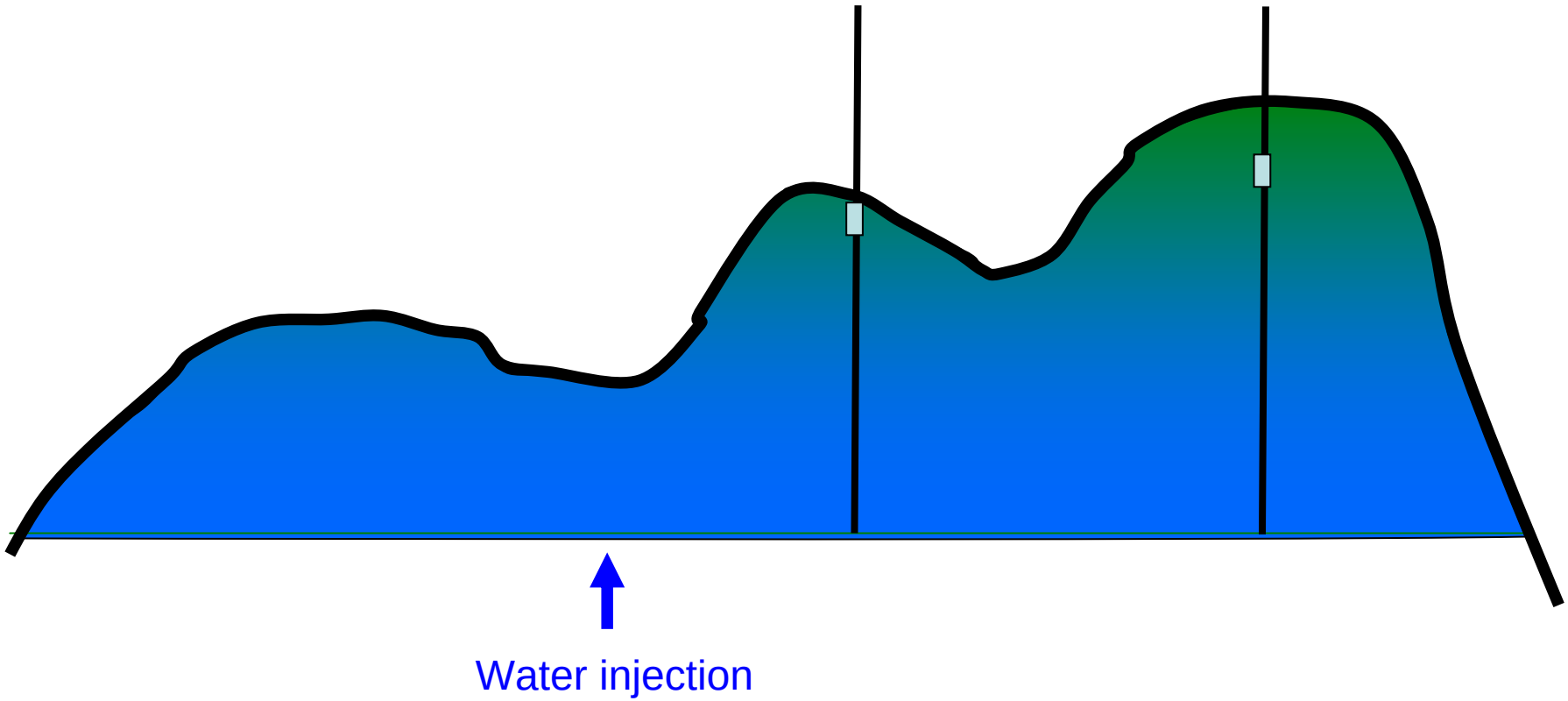

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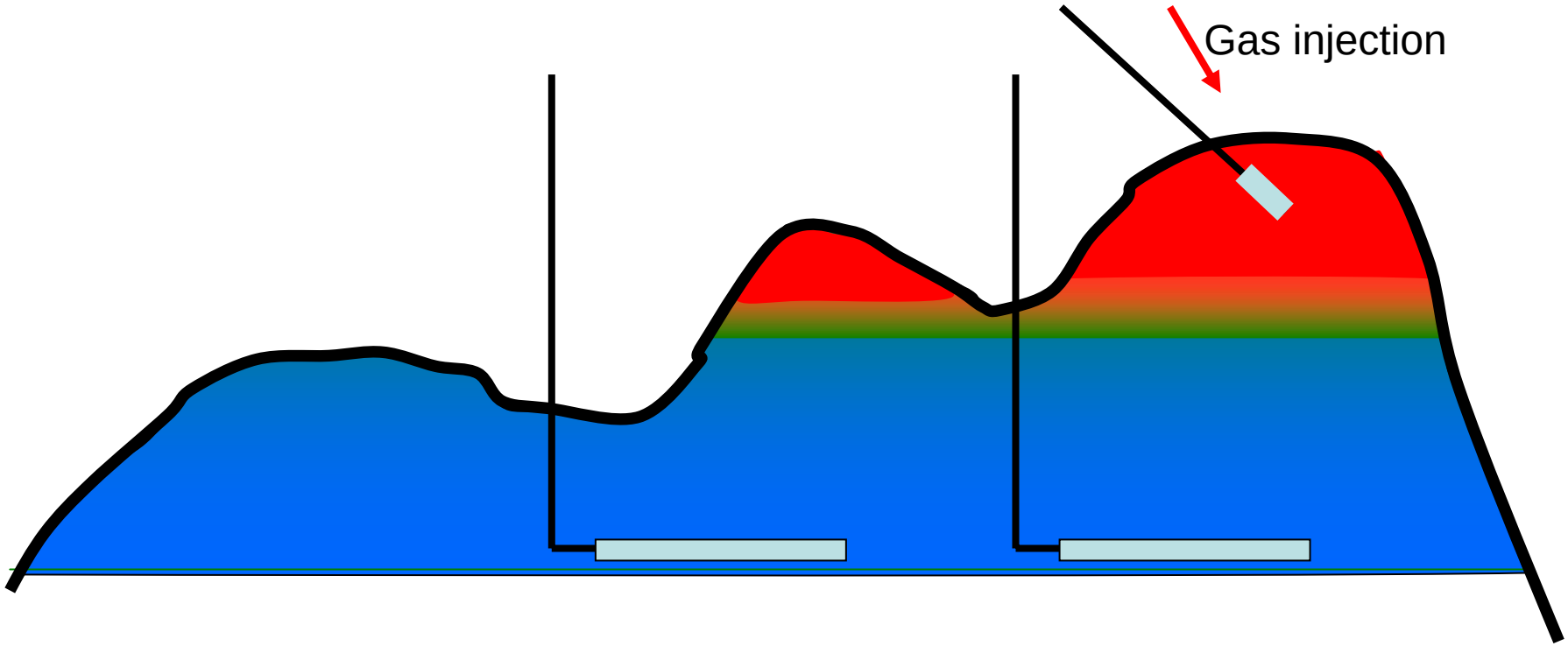

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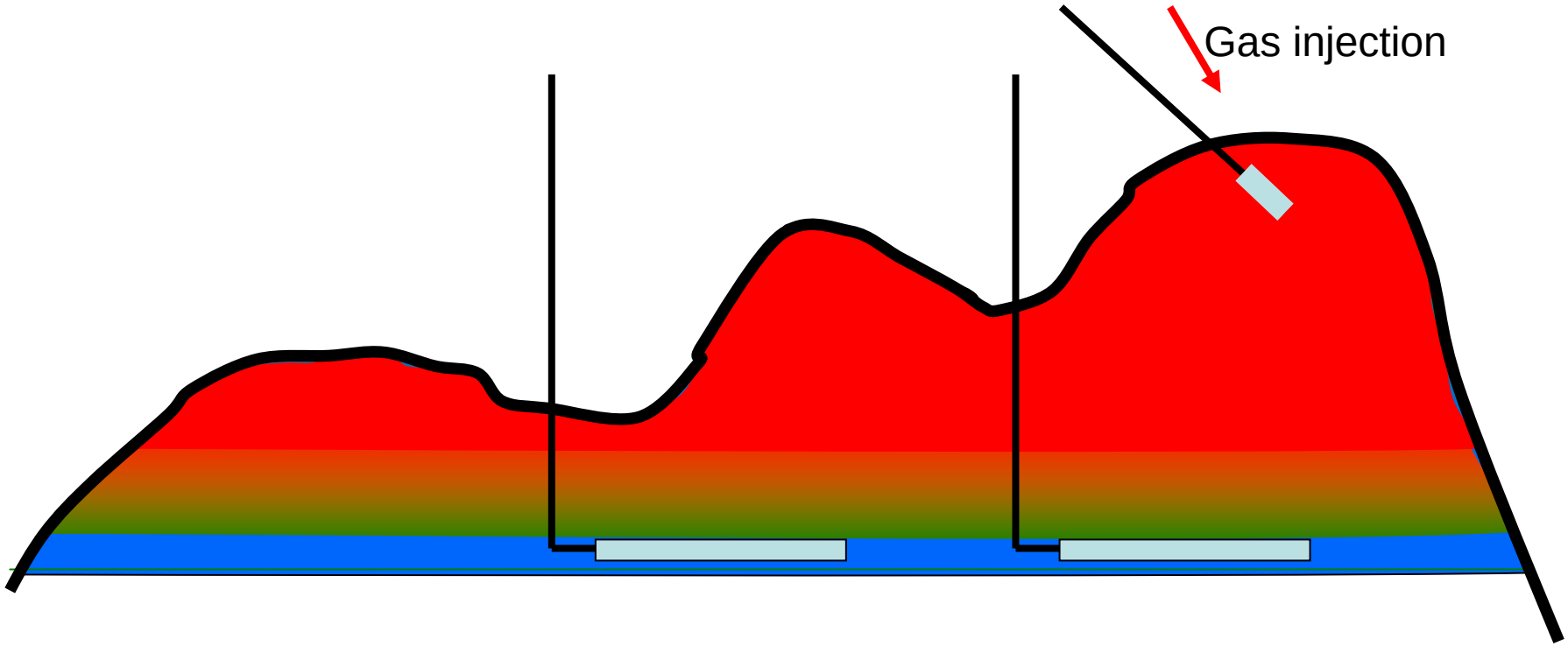
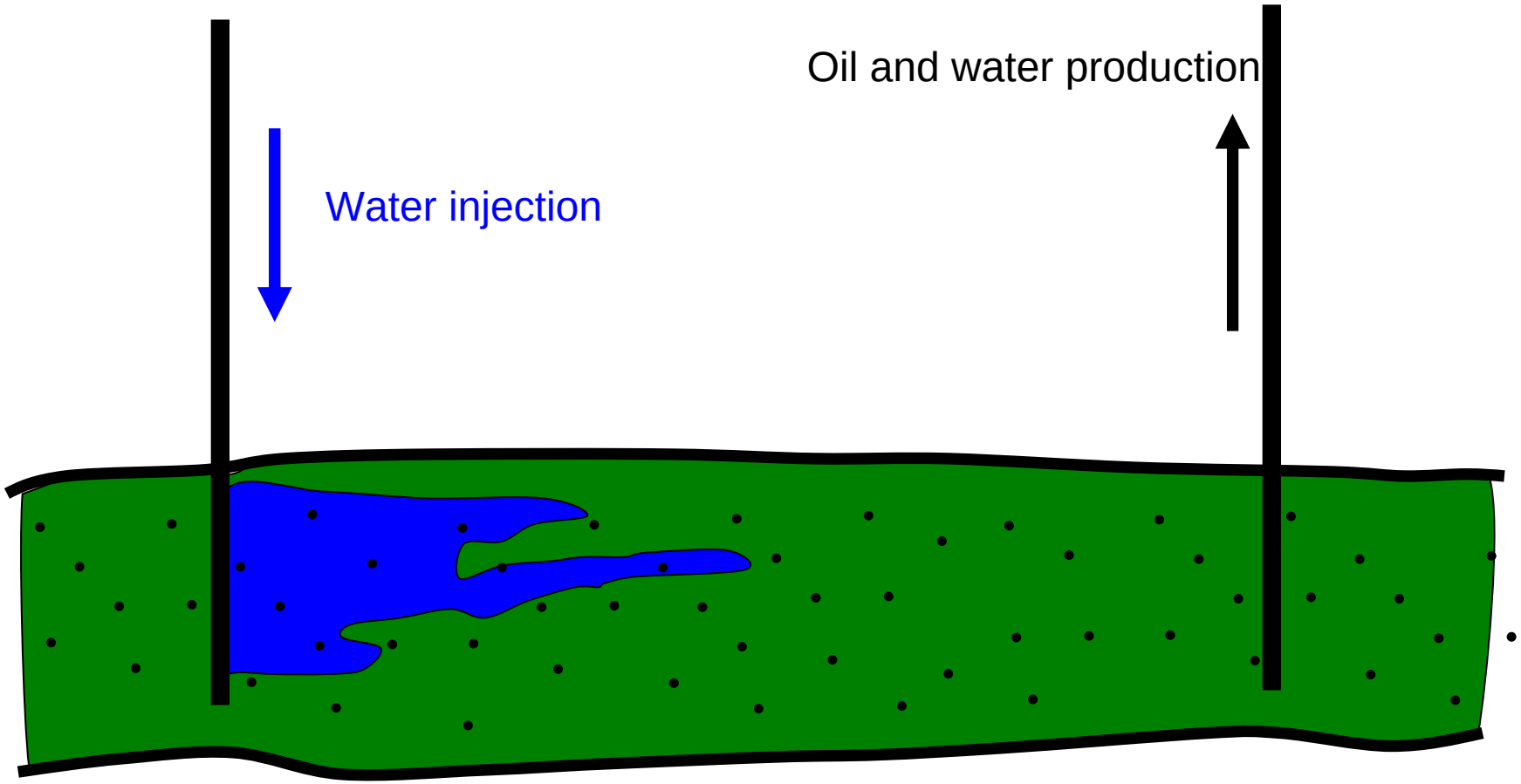
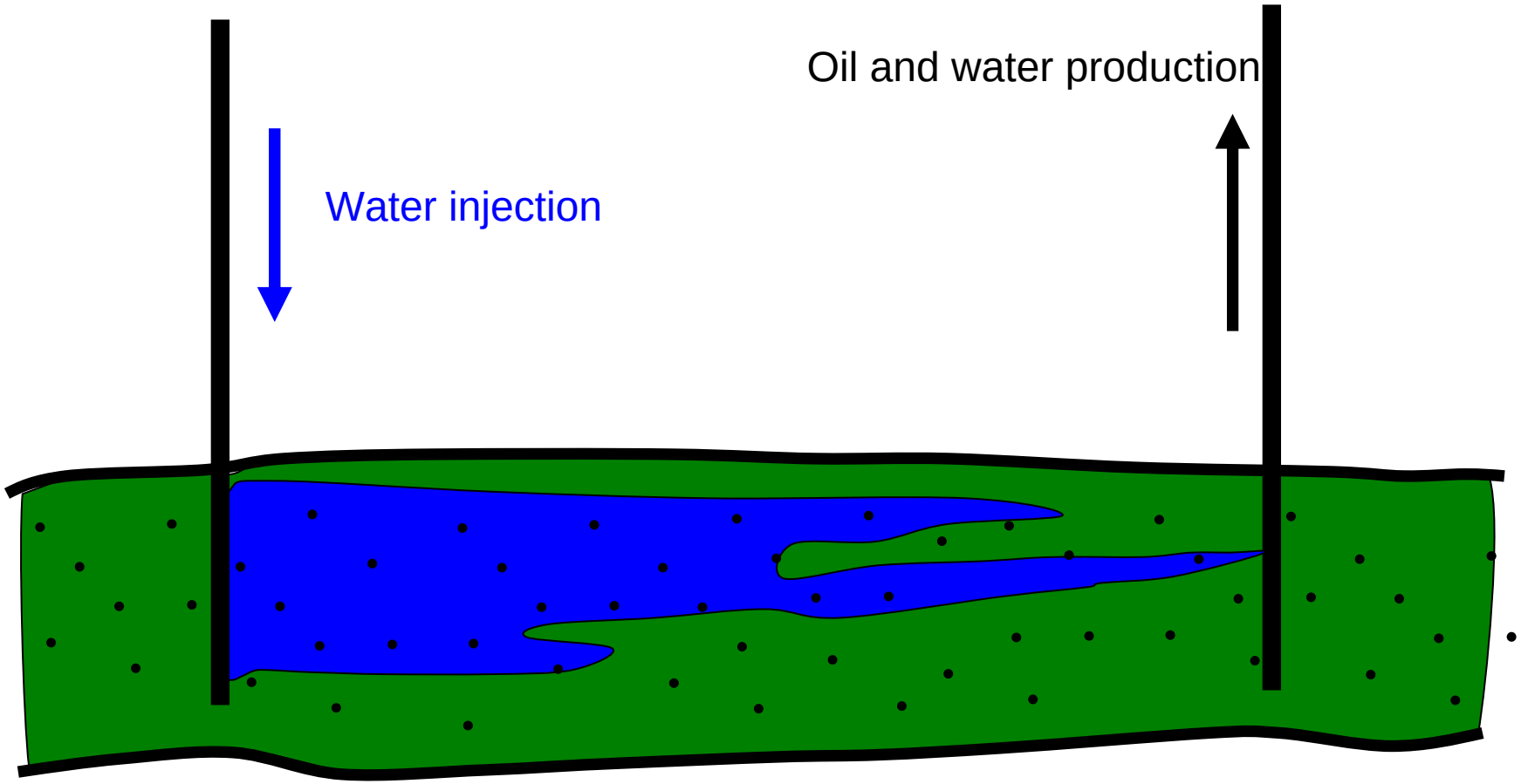


Polymer injection



Polymer injection



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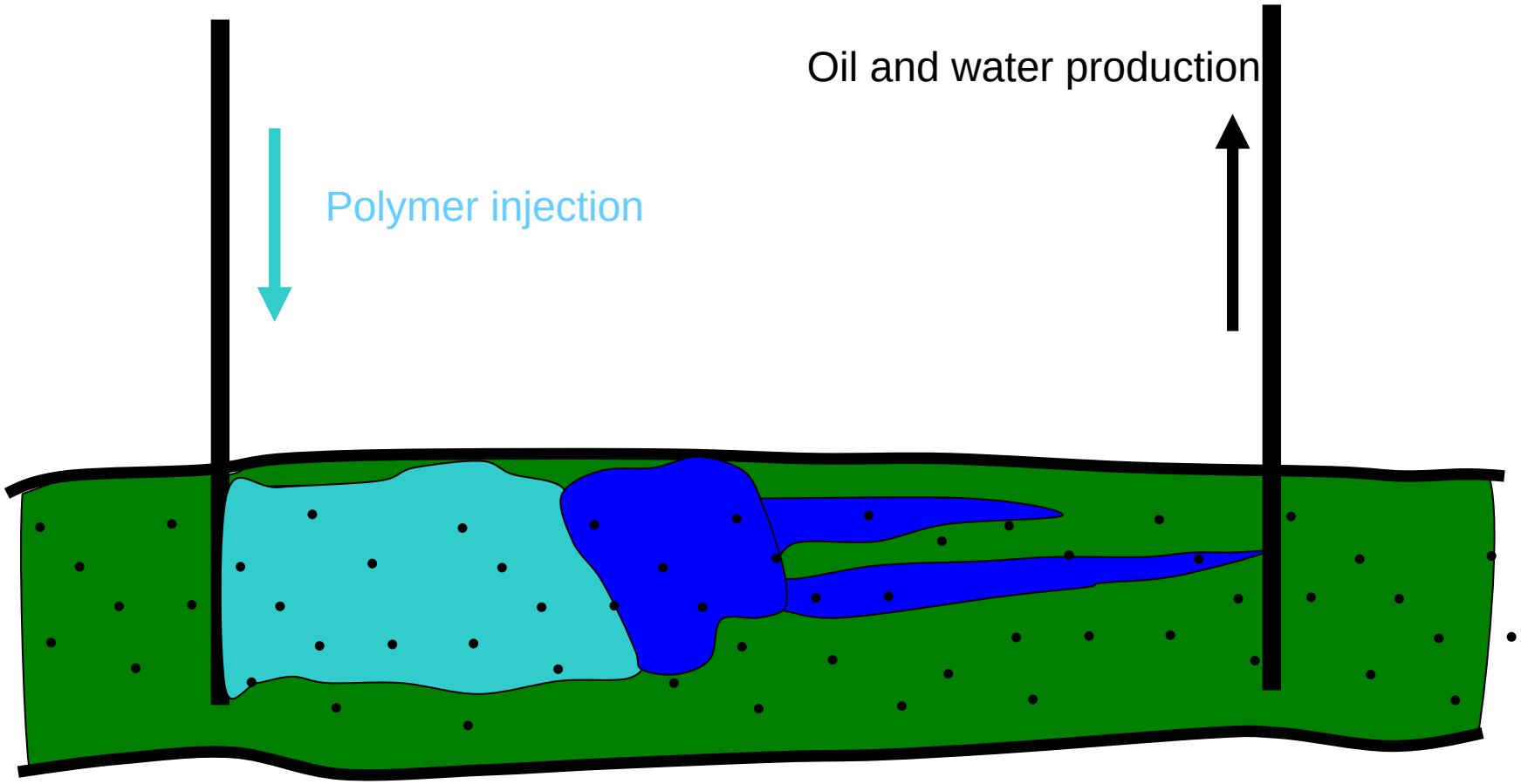

Summary of current research efforts of the IEA Joint Implementing Agreement on EOR

- Gas injection – behaviour of cost-effective gases in the subsurface (CO_2, air)
- Chemical injection – injection of polymers, surfactants, alkali
- Air injection for heavy oil recovery – in-situ combustion

Conclusions

- Higher oil prices increase interest in Enhanced Oil Recovery (EOR) methods
- Dependent on oil quality and the reservoirs, different EOR methods have to be used
- Member countries of the IEA EOR joint implementing agreement are very active
- Research for EOR of the IEA member countries focuses on gas and chemical injection