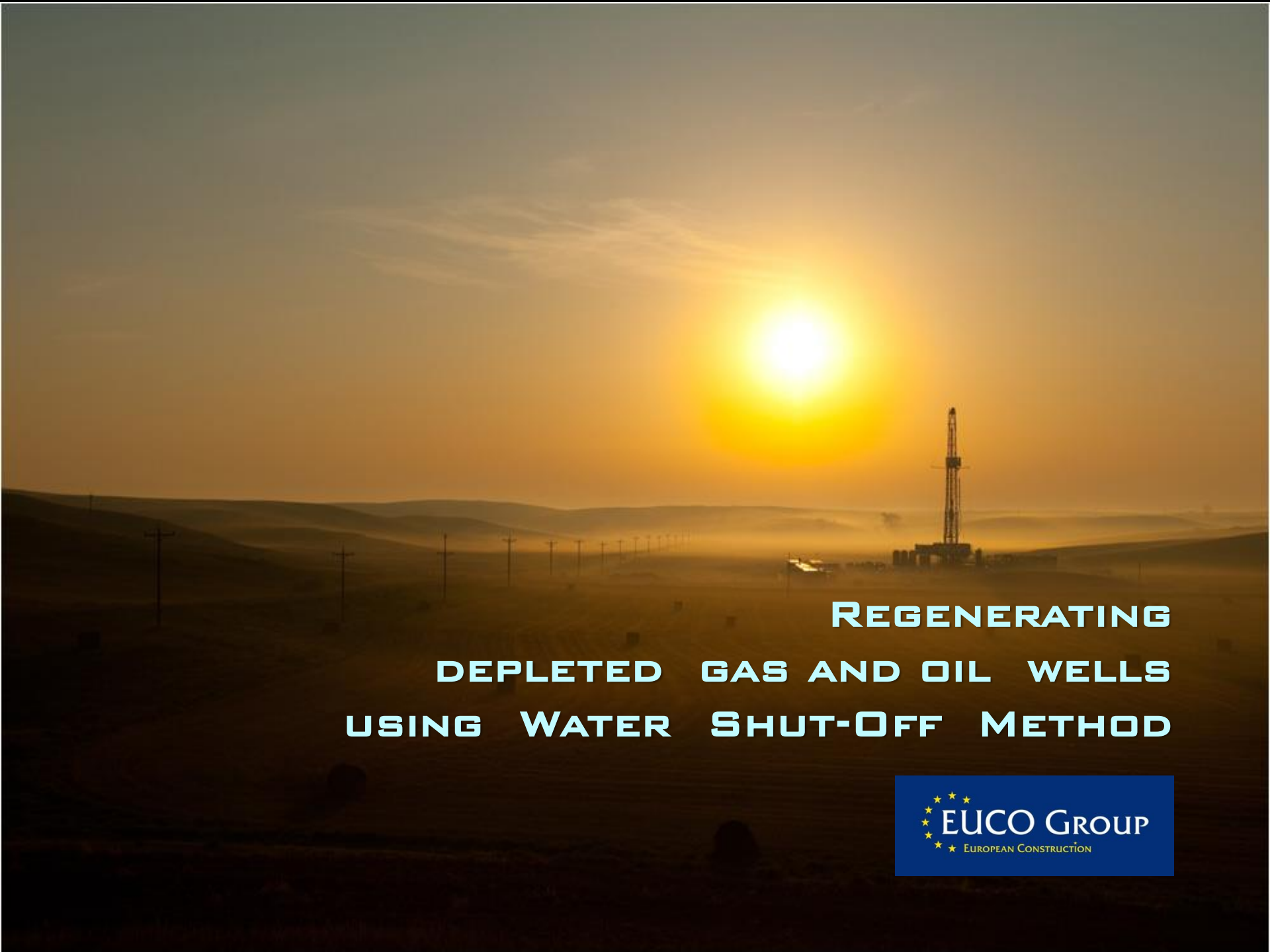
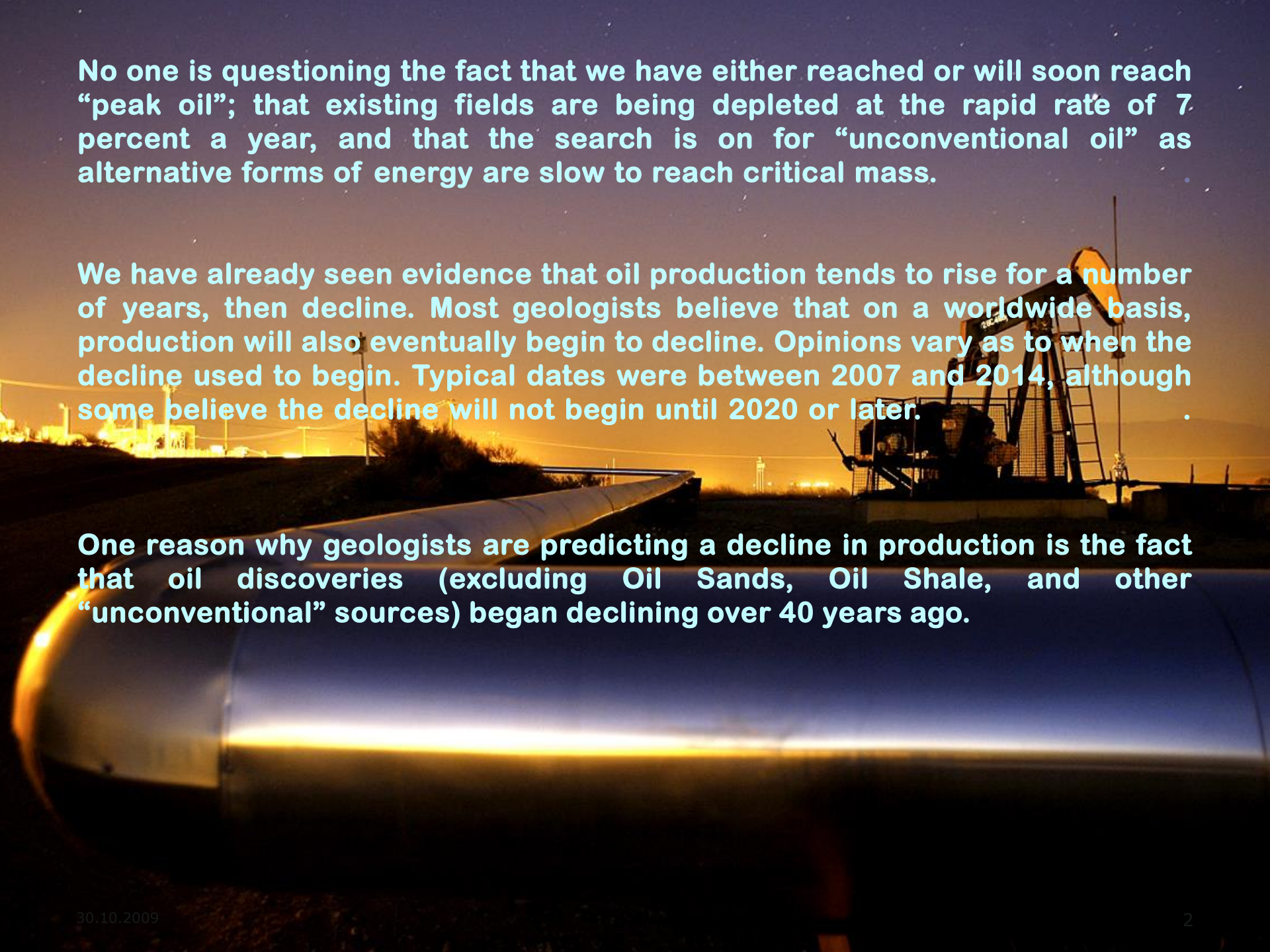


Regenerating depleted gas and oil wells using Water Shut-Off Method

EUCO Group
European Construction

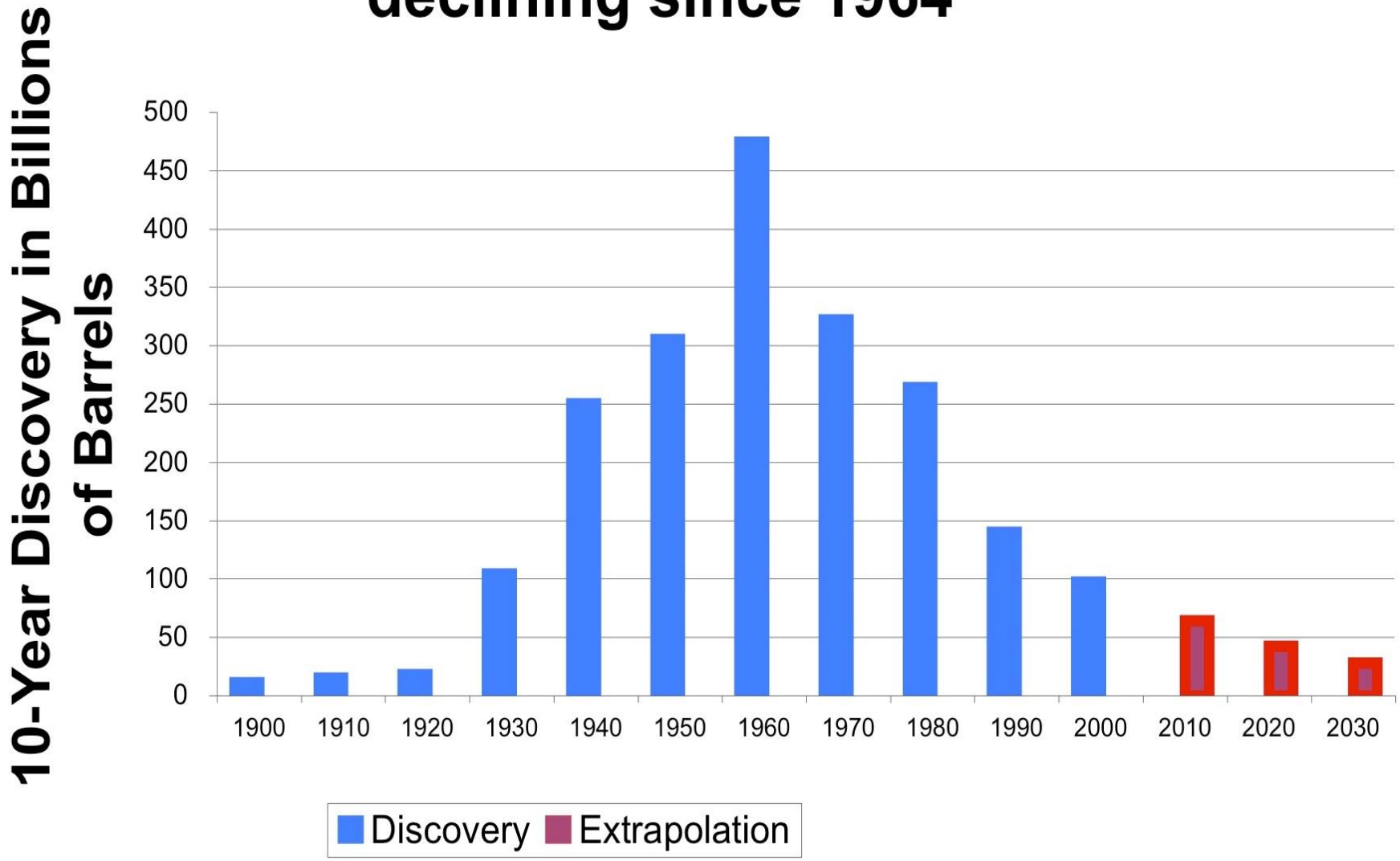


No one is questioning the fact that we have either reached or will soon reach “peak oil”; that existing fields are being depleted at the rapid rate of 7 percent a year, and that the search is on for “unconventional oil” as alternative forms of energy are slow to reach critical mass.

We have already seen evidence that oil production tends to rise for a number of years, then decline. Most geologists believe that on a worldwide basis, production will also eventually begin to decline. Opinions vary as to when the decline used to begin. Typical dates were between 2007 and 2014, although some believe the decline will not begin until 2020 or later.

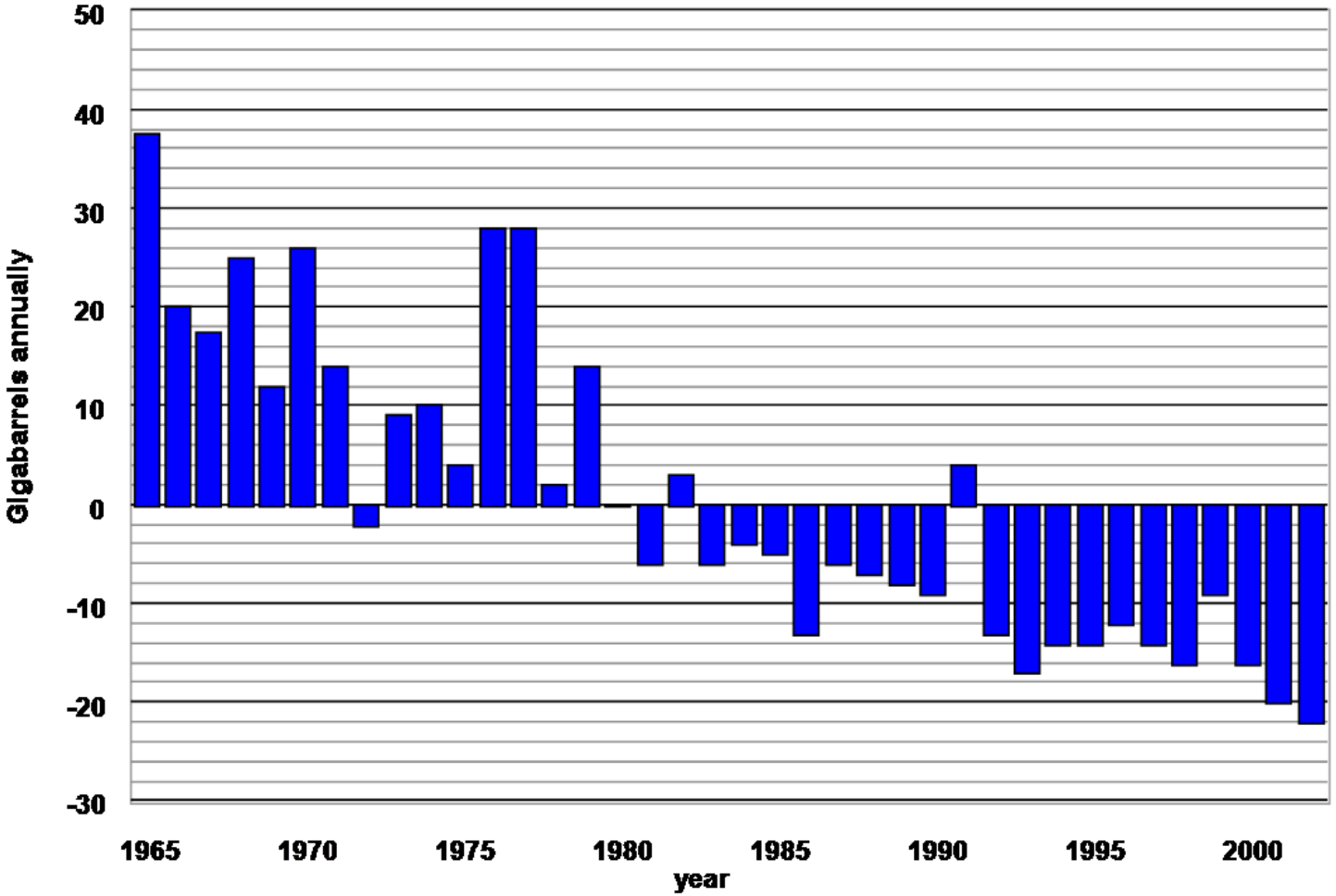
One reason why geologists are predicting a decline in production is the fact that oil discoveries (excluding Oil Sands, Oil Shale, and other “unconventional” sources) began declining over 40 years ago.

Figure 5: Oil discoveries have been declining since 1964



Note: World oil discovery over 10-year periods, by Association for the Study of Peak Oil and Gas.

Global oil discoveries minus global oil consumption 1965-2003



Source: Heinberg 2004, "*Powerdown*", Figure 5 page 43

Until well into the 1970s, new global oil discoveries were more than sufficient to offset production each year. Since 1981, the amount of new oil discovered each year has been less than the amount extracted and used.

THE IMPACT OF WATER PRODUCTION ON OIL AND GAS WELLS

Water production is a major technical, environmental, and economical problem in oil and gas production.

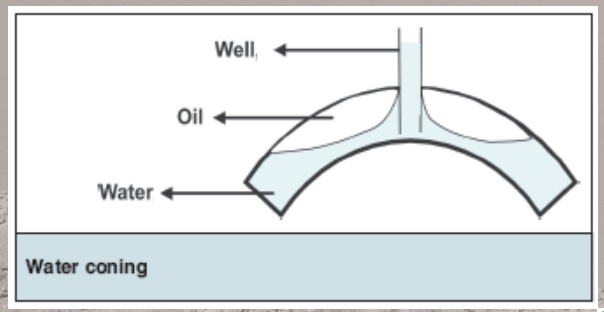
Water Production results in:

- More complex water–oil separation
- Fines migration
- Hydrostatic loading
- Rapid corrosion of tubular and well equipments
- Rapid decline in hydrocarbon recovery
- Premature abandonment of the well

Water production limits the productive life of oil and gas wells

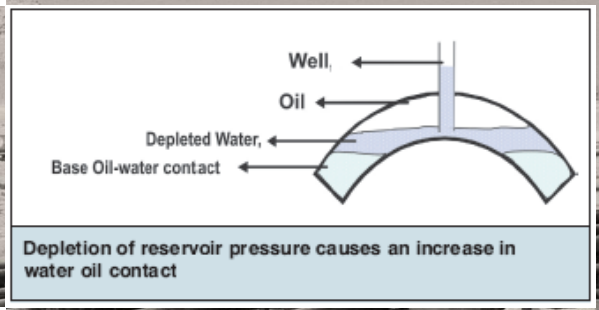
Produced water represents the largest waste stream associated with oil and gas production.

I. Water coning



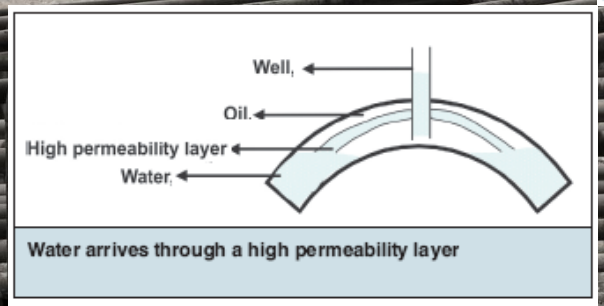
Water coning

II. Global increase of the water and oil contact



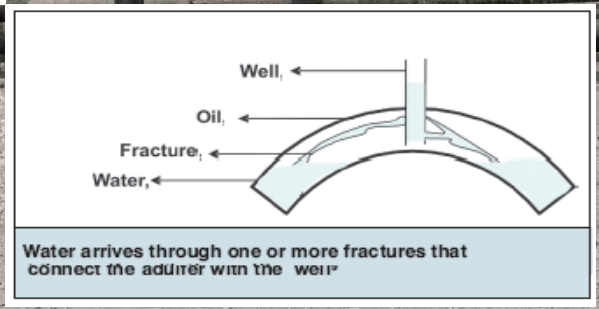
Depletion of reservoir pressure causes an increase in water oil contact

III. Water arrives through a high permeability Layer



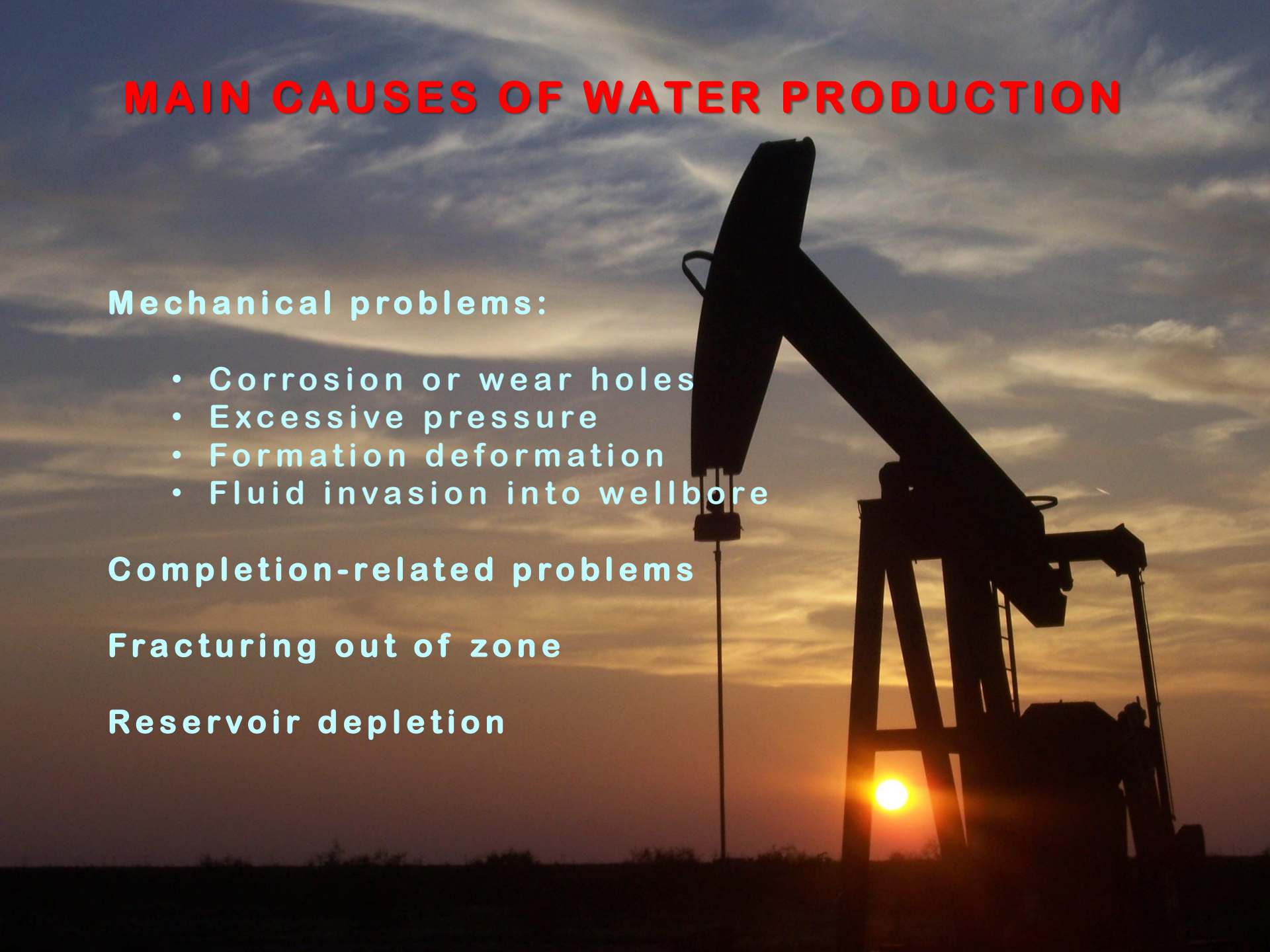
Water arrives through a high permeability layer

IV. Water flows through one or more fractures that connect the aquifer to the well



Water arrives through one or more fractures that connect the aquifer with the well

MAIN CAUSES OF WATER PRODUCTION



Mechanical problems:

- Corrosion or wear holes
- Excessive pressure
- Formation deformation
- Fluid invasion into wellbore

Completion-related problems

Fracturing out of zone

Reservoir depletion

WELL KNOWN WATER SHUT - OFF TECHNIQUES

There exist countless techniques, including polymer and polymer/gel injection, other gel systems, organic/metallic cross linkers, various combinations of any of these, mechanical solutions, cement plug solutions and hundreds of other, different, mechanical and chemical methods for water shut-off.

From amongst all these, our experience shows that, for many cases, innovative water-control technology can lead to the most significant cost reductions and improved oil production.

POLYMER FLOODING TREATMENT

Polymer flooding as one of the best Chemical Enhanced Oil Recovery mode is a very effective method of stratum water shut-off that increases oil/gas recovery and reduces water production. It significantly increases percentage of oil/gas recovery by reducing the water production percentage at an equal quantity of extraction.

Polymer types:

- Biopolymers
- Synthetic polymers

DIFFERENT POLYMERS COMPARED

Type	Advantages	Disadvantages
PAA: Polyacrylamide (Partially hydrolyzed)	- high yield in normal water - high injectivity	- not salt resistance - shear sensitivity - O2 sensitivity
Hydroxyethylcellulose (HEC)	- well soluble - salt resistance	- pH sensitivity - Fe+3 sensitivity - low temperature resistance - no structural viscosity
Biopolysaccharide (Xanthan, Scleroglucan)	- high yield in salt water - shear stable - temperature stable - low adsorption value	- Injection problems - bacteria sensitivity - O2 sensitivity - high cost
Co- and Terpolymers	- well soluble - salt resistance - temperature stable - shear stable	- O2 sensitivity - high cost

Source: Moawad T., ”A stimulation case study for economically improved oil recovery and water Shut-off strategies on the basis of the stratified high temperature oil reservoir” Ph.D Tu-Clausthal, Germany.

The Water Shut-off Technology

- Our Water Shut-off Technology is defined as an operation that hinders water from reaching and entering the production well.

- The complete procedure for the Technology is protected by utility patents that are owned by the shareholders of our subsidiary corporation.

- The Technology comprises the whole injection operation of the polymer composite into the oil or gas well, based on the well´s geophysical properties.

- Former experiences acknowledge that the treatment with our composite material causes recovery of production capacity of the well as follows:

  - Additional 55% - 80% of oil/gas output of the well´s „first“ productive life – if we treated only one well.
  - Additional 80% - 140% of oil/gas output of the well´s „first“ productive life – if we treated selected well(s) of one oil/gas field.

DYNAMICS OF WATER PRODUCTION ON A WELL

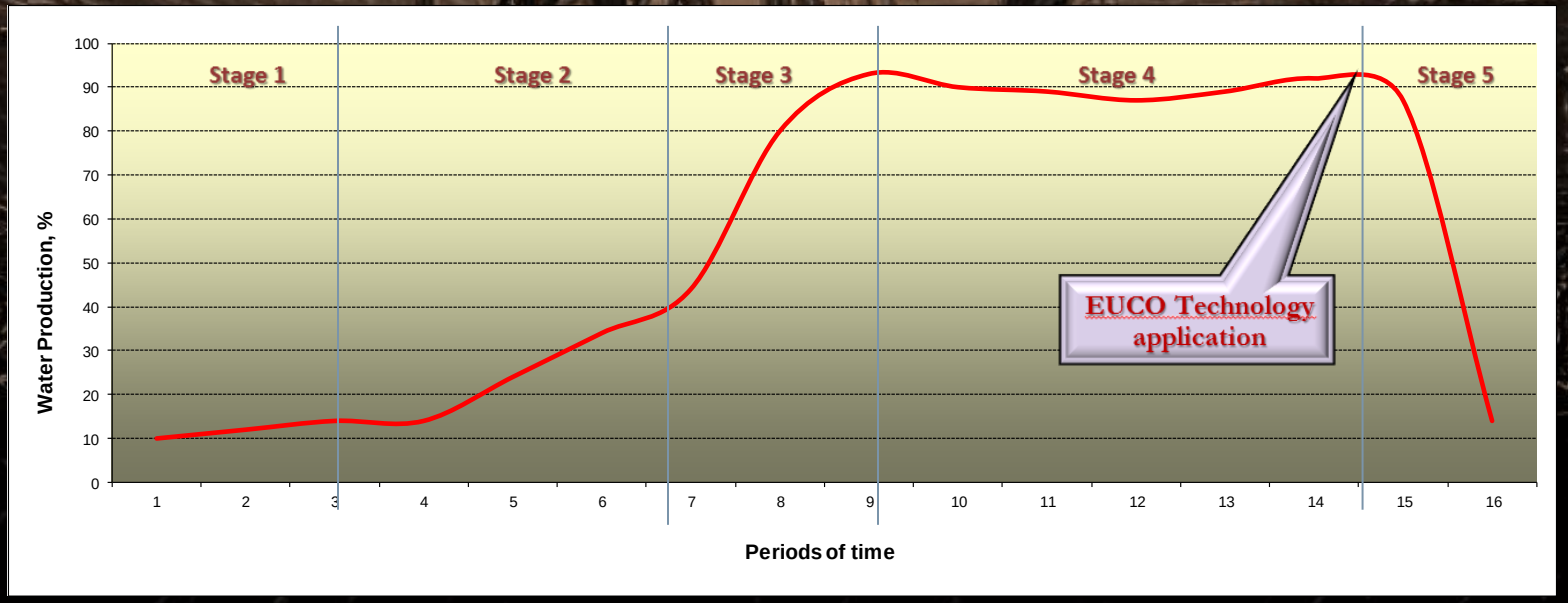
Stage1: Water intrusion in the extracted product

Stage2: Constant increase of the water yield

Stage3: Sharp increase of the water inflow

Stage4: Stabilization of the water production

Stage5: Water shutoff technology application takes effect

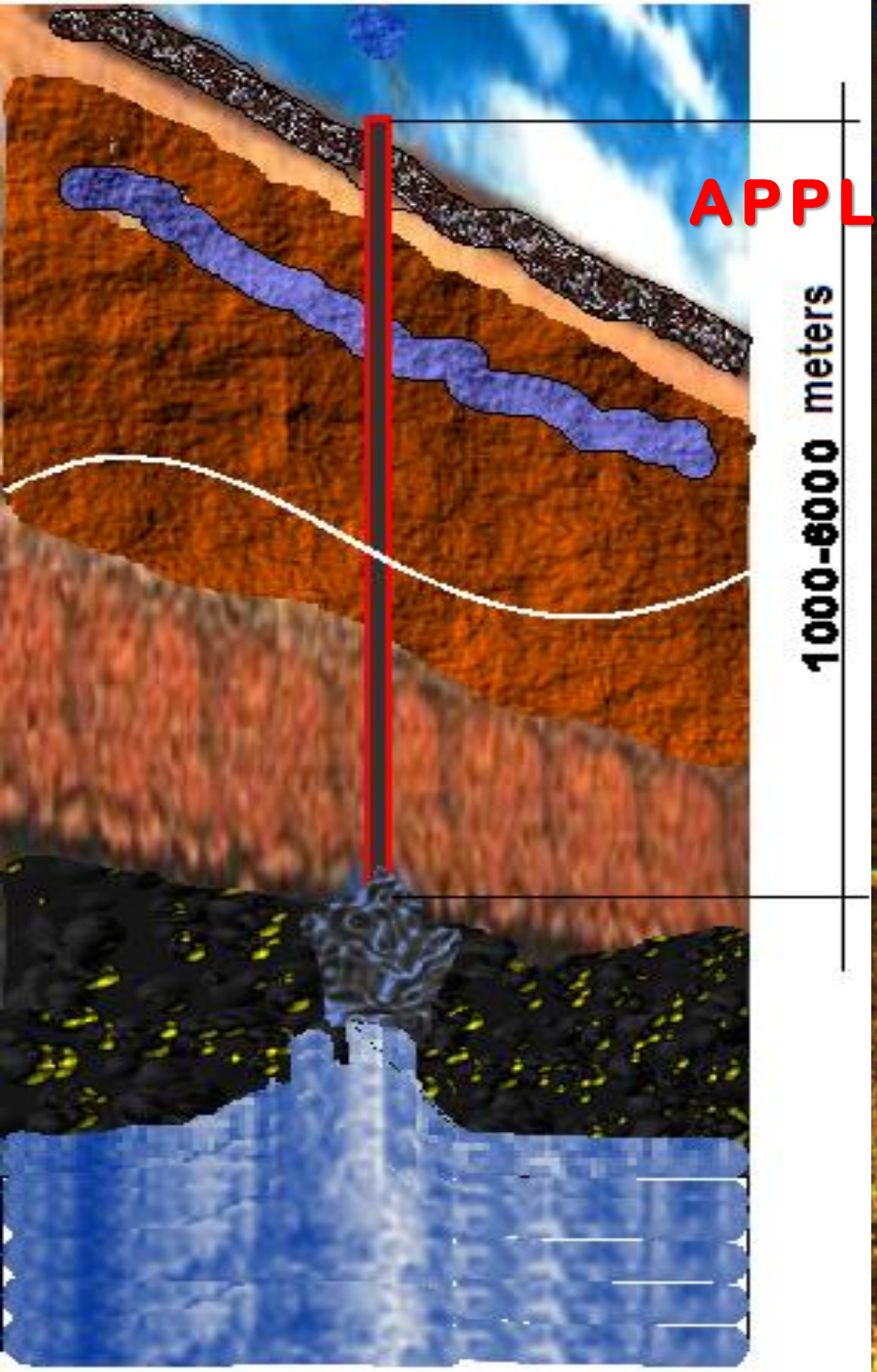


EFFECTIVENESS

- Known methods of oil extraction give an efficiency coefficient for oil/gas recovery only in the range 0.25 to 0.35

- Application of our Technology increases the efficiency coefficient from one well to within the range 0.60 - 0.80

- The skill and experience gained over ten years´ successful implementation of our Technology in the Russian and Ukrainian oil/gas market guarantee the quality of our services and the professional performance of our work for our clients´ wells´ regeneration.



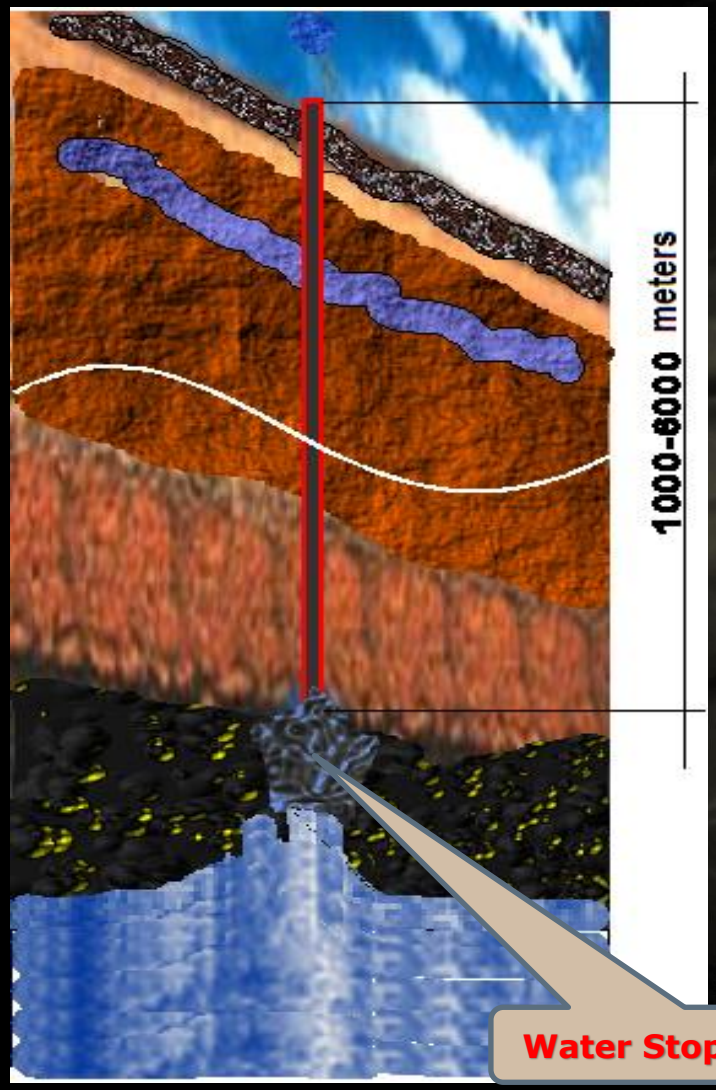
APPLICATION EXPERIENCE

- Well Depth range:
  from 1,000 m to 6,000 m

- Well Bottom Temperature range:
  from + 60°C to + 190°C

- Well Bottom Pressure range:
  from 1,2 MPa to 25 MPa

TECHNOLOGY MATTER AND DUTY CYCLE



- Analysis of well characteristics data and materials — 15 days
- Preparing the well characteristics dependet polymer composite — 20 days
- Pumping the polymer composite into the well — 5 days
- Holding the well under pressure.
- Polymer composite in process of transformation to complex molecular Water Stop Membrane — 35 days

THE EUCO GROUP WILL SUPPLY

- Proprietary Water Shutoff Technology based on patented synthetic polymeric composites.
- Special technological cards allowing application of our Technology to each specific case (based on the basis of the technical passport and logbook of the well).
- A high-quality service, built from our long-term scientific and practical experience, which adapts our research and development groundwork to allow the swift and efficient resolution of the many different complex tasks specific to each well.

The process has been tested on more than 40 oil-producing wells in 11 different soils and over a range of water salinity from 3,000 ppm to 200,000 ppm at a temperature of 70° Celsius. The proportion of water to oil at the wellhead at commencement was between 70% and 100% and was decreased to between 5% and 20% over the majority of the treated wells. In addition, the rate of oil production was increased in most of them. From an economic point of view, the process of injection of the individually-tailored polymer composite proved its claim of low operating costs and low acquisition costs for the chemical constituents.
The tests for single phase flow that were conducted to determine the level of adsorption of the polymer and its residual resistance factor (RRF) consisted of pumping.

The method has been applied in regions including Urengoy, Yamburg and Tyumen (major drilling fields) in Russia; in the Ukraine for JSC "Chornomornaftogaz"; on offshore platforms number 2, 4, 5 and 18, which are located on the continental shelf of the Black Sea; and at the No. 4 sea stationary platform of the Golitsynsky gas condensate field. Companies currently interested in developments using the technology include SE “Urengoygazprom”; CC “Neftegazmontazh”; “Neftegazstroyservis”; RJCC “Gazprom”; and SE “Yamburggazdobycha”.

The single most important element in the elimination of water influx through the application of composite materials is expertise; expertise born of long-term experience in the correct selection of composite materials based on geophysical studies of the well.

We carry out the water shut-off works through our local subsidiary companies. We draw on 22 patented solutions, chemicals, know-how, and the Technology implementation. These patents are owned by the shareholders of our subsidiary company.

After initial analysis, the chemicals modification and composite material injection into the well, it is held under pressure about 35 days, following which the well re-starts production.

FOR THE SUCCESSFUL ELIMINATION OF WATER INFLOW, WE OFFER:

1. To design a synthetic polymeric composite specific to the well's properties, including the methodology for absorption zone isolation and in response to the formation of the water flow in the borehole;
2. To follow our methodology for composite calculation from 36 base materials and 20 additives;
3. To employ our Technology to inject the specific composite into the well mouth;

Before our advice and suggestions about using of our technology in specific wells, the customer should provide to us following information:

1. The well performance in m^3 per day.
2. Reservoir pressure in MPa.
3. Well temperature in ° C
4. Static pressure in MPa
5. Dimensions of the lower zone of the well.
6. Water volume measurement at the wellhead in m^3.
7. Supplemental information about geophysical and hydrodynamic studies – if any.
8. Supplemental information about fluid saturation of the layers – if any.
9. Supplemental information about layer's pressure, temperature: the initial and in the dynamic – if any.
10. Supplemental information about the dynamics of the gas flow and mineral extraction – if any.
11. The design depth of the well in m.
12. Real depth / actual depth of the well in m
13. Perforation intervals in the water reservoir 1,2,3,4 etc. / 1,2,3,4 , etc.
14. Cementing condition (state of cement stone) throughout the whole production casing and production sectors too.
15. Real excavation performance (oil, gas and gas condensate) of the well from the beginning of its development in m^3
16. Debit of well productivity for all operation/production life.
17. Liquidity of recovery and saturation (gas, oil, condensate factor, etc.).

18. All available well logging books, their recording data and hydrodynamic studies.
19. Samples (core) reflecting all available characteristics of the well.
20. Technical Operations´ chronology (in terms of the history of the well).
21. Well construction (geometric parameters) and compressed pressure.
22. Supplemental information about construction of the well and the pressing pressure – if any.
23. Supplemental information about the arrangement of the tubing, the condition, the size, etc. – if any.
24. Construction of the wellhead (types column head and CT).
25. Pipeline scheme and its condition.
26. Construction of the mouth (types of columns/casing and design of Christmas tree of the wellhead.
27. Supplemental information about the history of the well.
28. Data of the well repairs/corrections or well work-over (if they were done) and results.
29. Attempts to activate/recover the well, efforts of reserves intensification or application of waterproofing technology. What kinds of technologies were applied?
30. Wells´ geographic location and transport routes to it. GPS coordinate.

The full range of necessary works and equipment to be used for the application of the specific polymeric composite can be prepared only after determining and expert analysis of each specific well's characteristics.

www.eucogroup.eu
Boris.Svasta@eucogroup.eu
tel: + 421 / 911 / 451 148

EUCO GROUP
EUROPEAN CONSTRUCTION