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Ocean Environmental Management

Offshore energy resources

HAI PHONG – 2020



OIL AND GAS

- Oil and natural gas are naturally occurring chemicals that are made up of just two elements -- carbon and hydrogen.
- The class of chemicals based on carbon and hydrogen are called hydrocarbons.
- The simplest hydrocarbon, methane, is made up of one carbon atom and four hydrogen atoms.
 - Other hydrocarbons like octane and octadecane have more complicated structures.
 - Plastics are made of molecules called polymers that are very long chains of hydrocarbons.

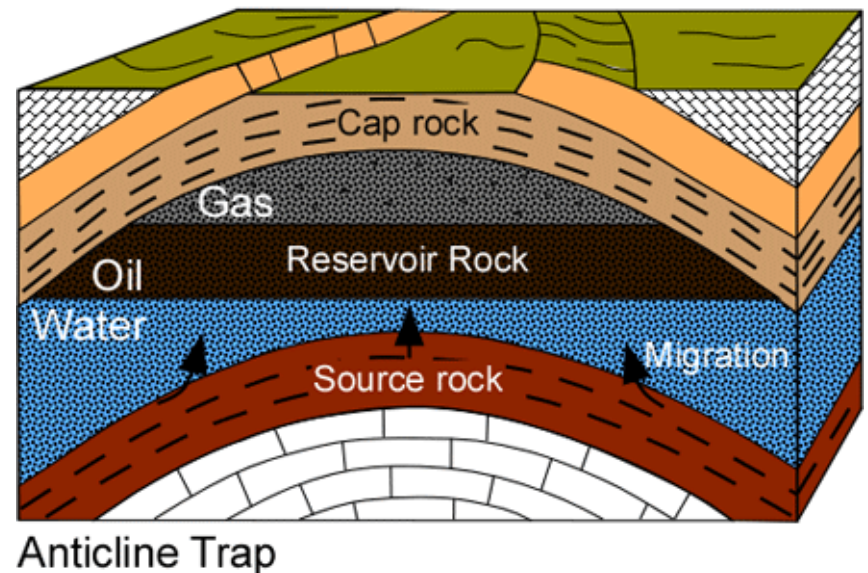
How Are Oil/Natural Gas Formed?

- **Stage 1**

- All of the oil and gas we use today began as microscopic plants and animals living in the ocean millions of years ago.
- As these microscopic plants and animals lived, they absorbed energy from the sun, which was stored as carbon molecules in their bodies.
- When they died, they sank to the bottom of the sea.
- Over millions of years, layer after layer of sediment and other plants and bacteria were formed.

How Are Oil/Natural Gas Formed?

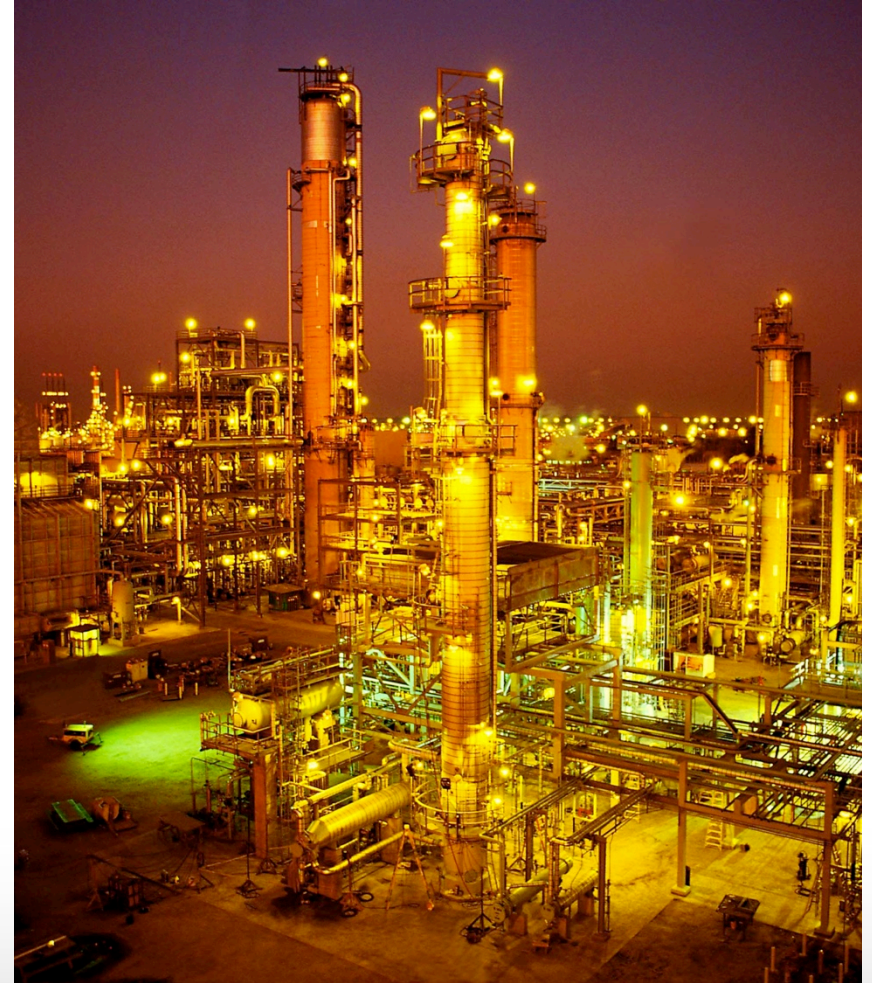
- **Stage 2**
 - As they became buried ever deeper, heat and pressure began to rise.
 - The amount of pressure and the degree of heat, along with the type of biomass, determined if the material became oil or natural gas.
 - More heat produced lighter oil. Even higher heat or biomass made predominantly of plant material produced natural gas.



How Are Oil/Natural Gas Formed?

- **Stage 3**
 - After oil and natural gas were formed, they tended to migrate through tiny pores in the surrounding rock.
 - Some oil and natural gas migrated all the way to the surface and escaped.
 - Other oil and natural gas deposits migrated until they were caught under impermeable layers of rock or clay where they were trapped.
 - These trapped deposits are where we find oil and natural gas today

Where is Petroleum Found?



Where is Petroleum Found?

- Oil and natural gas reserves are found in many parts of the world.
 - In the past, demand was low and reserves were easy to find.
 - In fact, the first users of oil depended on surface seepage for their supplies.
 - However, as demand has increased, all the easy-to-find oil has been used.
- Today, oil exploration takes place in some of the most challenging places on earth.
 - We are now looking for new oil reserves thousands of feet under the ocean and in areas of climatic extremes.

Will we run out?

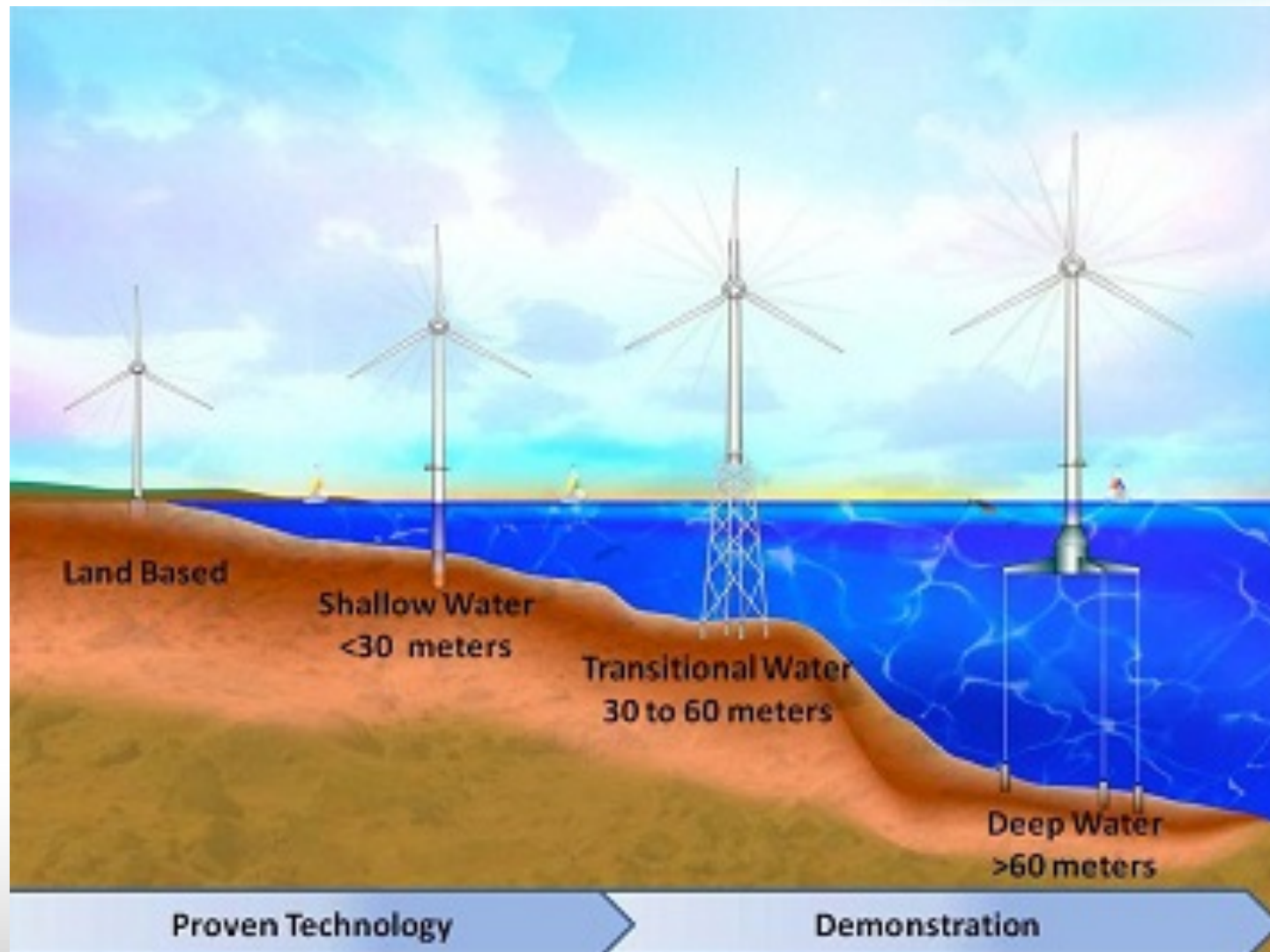
- At our current rate of use, we have oil and natural gas reserves to last 60-90 years.
- Finding economical ways to extract oil from coal tars and oil shales could provide supplies for hundreds of years.
 - Ability to find and extract oil and natural gas from new sources expands almost every day!
 - We now produce natural gas from buried coal seams, oil and natural gas from deep deposits located miles beneath the surface of the earth, and in the deep ocean, hundreds of miles offshore and in water depths greater than 10,000 feet.
- Alternative energy such as wind, solar, geothermal and biomass to make these potential energy resources more reliable and affordable to meet the growing need for energy.

Class discussion

Environmental problems caused by the production and consumption of Petroleum?



Offshore wind, wave and tidal energy



Offshore wind, wave and tidal energy

- Harnessing energy from offshore winds, waves, and tides holds great promise for our nation's clean energy future.
 - Energy production is just one of the valuable resources our oceans and coastal ecosystems provide.
 - We can successfully develop offshore renewable energy by ensuring that energy projects are sited, designed, and constructed in a manner that protects our fragile ocean ecosystems.

How Offshore Renewable Energy Works

- **Offshore Wind**

- Energy from offshore wind is generated from wind turbines, similar to land-based turbines, which are usually attached to the sea bed using a fixed foundation.
- In deeper waters, floating platforms are needed to support the wind turbines.
- Several types of floating platform technologies are under development.
- When the wind blows, the blades of the turbine rotate and power a generator that converts wind energy into electricity.
- The electricity is typically transported to shore through cables along the ocean floor.
- As technology advances, offshore wind turbines will increase in size and efficiency, enabling them to be moved farther out to sea, where they will harness stronger winds, and produce even more energy at a lower cost.

How Offshore Renewable Energy Works

- **Waves, Tides, and Currents**

- Marine hydrokinetic energy comes from the energy contained in waves, tides, or ocean currents.
- The devices that harness this energy are among the newest renewable technologies.
- They range from buoys, to clam-like shells on the sea bottom, to underwater versions of wind turbines.
- Many of them are still being tested and refined.

Advantages of Offshore Renewable Energy

- Offshore renewable energy has the potential not only to add to our clean energy mix, but to create jobs as well.
- Building and maintaining offshore energy facilities is labor and material intensive, requiring everything from turbine blades to skilled technicians.
- Developing this energy resource has the potential to create tens of thousands of good jobs all along the supply chain.

Where Offshore Renewable Energy is Used

- Offshore wind energy is running in many places around the world.
 - In Europe, some 53 offshore wind projects, totaling almost 3,800 megawatts (MW) of capacity, are producing clean renewable energy off the coasts of 10 European countries, with nine more major offshore wind projects under construction.
 - The Walney wind farm off Cumbria, Great Britain, is the largest in the world, with more than 100 turbines generating 367 megawatts -- enough power for 320,000 homes.
 - China recently built its first offshore wind project, and has more underway.
 - In the United States, the East Coast holds the most promise for offshore wind energy development. Wave energy potential is stronger off California and Oregon, while Alaska and Maine have the large tide differences necessary to generate tidal energy.

Food for thought

1. Disadvantages of offshore oil and gas?
2. Disadvantages of offshore renewable energy?

