



ENERGY POLICY AND THE ENVIRONMENT

MDPI Oil & Gas Training

LEARNING OUTCOMES

- To gain an in-depth understanding and the application of the energy sector policy and its response to climate change commitments
- To explore the Ghanaian and international energy policy perspectives
- To gain practical knowledge on the effective implementation of environmental management strategies

OUTLINE

- ✓ The Energy Industry- What it is and what its not
- ✓ Rational for Energy Policy
- ✓ Ghana's Energy policy key highlights
- ✓ Energy Policies- Global perspectives
- ✓ Environmental Management
- ✓ Renewable Energy
- ✓ New Energy Policy Instruments (**NEPIs**)
- ✓ The Environment and Energy
- ✓ Climate Change
- ✓ The Future-Sustainable Energy

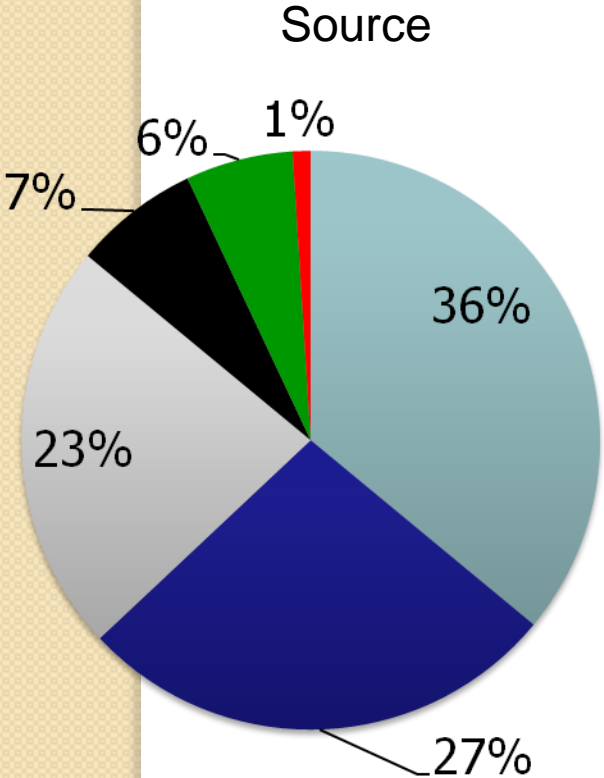
The Energy Sector

Energy Sector, what it is what is not?

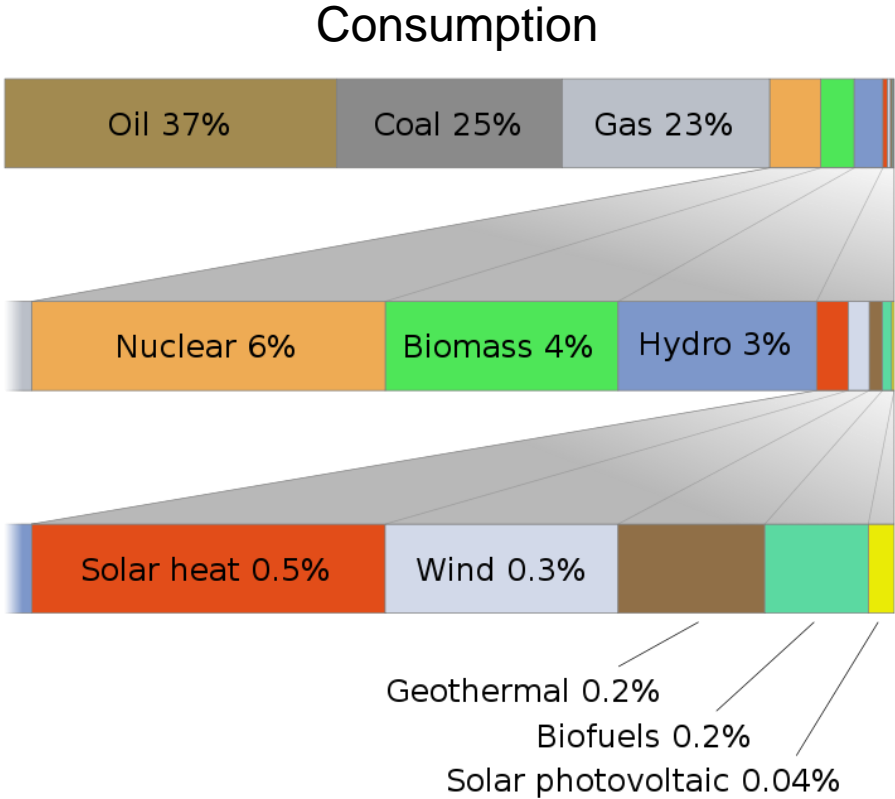
The energy sector is the totality of all of the industries involved in **the production and sale of energy**, including **fuel extraction, manufacturing, refining and distribution.**

Energy is fundamental to development hence its significance in international politics and trade.

There are five major primary energy sources in the world



- Oil
- Coal
- Natural Gas
- Hydro
- Nuclear
- Others



Energy Sector, what it is what is not?

Industry comprises:

- Petroleum industry, including oil companies, petroleum refiners, fuel transport and end-user sales at gas stations
- Gas industry, including natural gas extraction, and coal gas manufacture, as well as distribution and sales

Energy Sector, what it is what is not? Cont.

- Electrical power industry, including electricity generation, electric power distribution and sales
- Coal industry
- Nuclear power industry, and the
- Renewable energy industry, comprising alternative energy and sustainable energy companies, including those involved in

The Energy Industry

- **Energy Industry, what it is what is not?**
- hydroelectric power,
- wind power, and
- solar power generation, and
- the manufacture, distribution and sale of alternative fuels
- Biomass - traditional energy industry based on the collection and distribution of firewood, commonly used for cooking and heating in developing countries are all industry players.

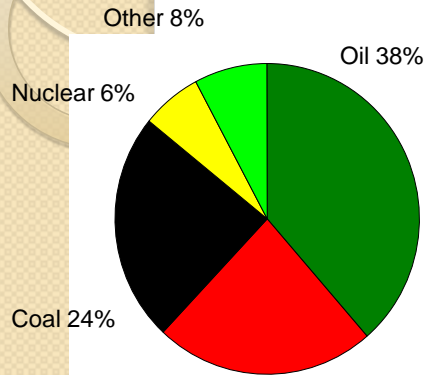
Energy Policy

Energy policy is the manner in which a given entity (often governmental) has decided to address issues of **energy development including energy production, distribution and consumption.**

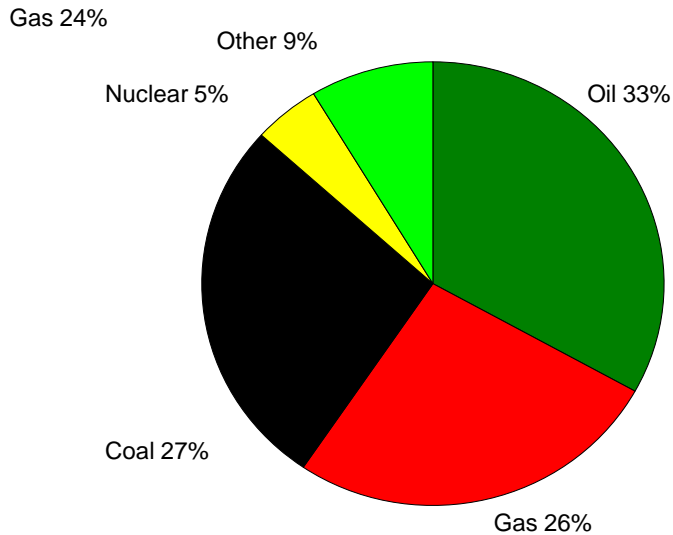
The attributes of energy policy may include legislation, international treaties, incentives to investment, guidelines for energy conservation, taxation and other public policy techniques.

The Problem - World energy demand is growing

Energy demand is growing



2003



2030

- Global energy demand rising
 - 2003 - 123 million GWh
 - 2030
 - 211 million GWh (+71%)
 - Driven by rapidly growing economies – China, India etc
- Oil / Gas / Coal share remains the same
- Renewables unable to deliver at this scale in time
- CO₂ problem continues to grow

Rational for a policy

- To provide direction and a framework for management and decision making
- To provide some clarity on the industry
- To provide other stakeholders a framework
- Provides a mechanism to coordinate and monitor activities of a sector
- Facilitate constructive dialogue
- To provide clients/partners with information on areas of business opportunities

Ghana's energy policy –key highlights

- This National Energy Policy outlines the energy sector goals, challenges and actions.
- The Policy covers a gamut of issues and challenges relating to the following areas:
 - I. Power Sub-sector;
 - II. Petroleum Sub-sector;
 - III. Renewable Energy Sub-sector;
 - IV. Waste-to-Energy;

Ghana's energy policy –key highlights Cont.

- v. Energy Efficiency and Conservation;
- vi. Energy and Environment;
- vii. Energy and Gender; and
- viii. Managing the future of the sector.

Ghana's energy policy –key highlights

- **The Power-Subsector**
- The goals of the Power sub-sector includes increasing installed power generation capacity from about 2,000 MW today to 5,000 megawatts (MW) by 2015, and increase electricity access from the current level of 66% to universal access by 2020.

Ghana's energy policy –key highlights

- **Petroleum Sub-sector**
- The goals of the Petroleum sub-sector includes ensuring sustainable exploration, development and production of the country's oil and gas endowment;
- Judicious management of the oil and gas revenue for the overall benefit and welfare of all Ghanaians; and
- Indigenisation of related knowledge, expertise and technology.

Ghana's energy policy –key highlights

- **Renewable Energy Sub-sector**
- The Renewable Energy sub-sector covers biomass, mini hydro, solar and wind resources.
- The goals of the Renewable Energy sub-sector includes increasing the proportion of renewable energy in the total national energy mix and ensure its efficient production and use.

Ghana's Energy Consumption and Supply Profile

- In 2008, Ghana's biomass (charcoal/wood fuel) energy consumption was 11.7 million tonnes, Petroleum products and electricity consumption were 2.01 million tonnes and 8,059 GWh, respectively.
- In terms of total energy equivalents, biomass (fuel wood and charcoal) constituted 65.6%, petroleum products 26% and electricity 8.4%.

Challenges in the Policy Implementation

- (i) inadequate infrastructure requiring huge investments;
- (ii) inadequate access to energy services;
- (iii) high cost of fuel for electricity generation;
- (iv) inadequate regulatory capacity and enforcement;

Challenges in the Policy Implementation Cont.

- (v) operational and management difficulties in utility companies
- (vi) vulnerability to climate change and environmental impacts
- (vii) inefficiency in the production, transportation and use of energy

Environmental Policy

Environmental policy is any course of action deliberately taken [or not taken] to manage human activities with a view to prevent, reduce, or mitigate harmful effects on nature and natural resources, and ensuring that man-made changes to the environment do not have harmful effects on humans.

Framework for Environmental Legislation

- The OSPAR Convention 1992 - is the convention for the Protection of Maritime Environment of the North East Atlantic. This is an international treaty in respect of preventing and eliminating pollution.
- Oil Pollution, Prevention and Control OPPC Regulations 2005 (UK)

- Early Treaties

- Oslo Convention 1972 – Convention for the Prevention of Maritime pollution by dumping from ships and aircrafts.
- Paris Convention 1974 – Convention on the prevention of maritime pollution from land based sources.

Enforcement of Environmental Legislation Cont.

Various Environmental legislations covers all aspects of offshore oil and gas regulations; Exploration, Production, Decommissioning and Abandonment. These legislations are enforced through:

- Licensing – Application process
 - Model Clauses
- The Ministry of Energy is the government department responsible for licensing and exploration enforcement and regulating developments of Ghana's oil and gas resources.

Enforcement of Environmental Legislation Cont..

- Environmental Protection Agency (EPA) collaborate with Ministry of Energy to regulate environmental issues relating to the oil and gas industry.

- *Environmental Legislation*

The Environmental Protection Act 490, 1994 establishes the Authority, Responsibility, Structure and Funding of the EPA.

The Act defines the requirements and responsibilities of the Environmental Protection Inspectors and empowers the EPA to request that an EIA process be undertaken.

EPA Guidelines on Environmental Impact Assessment for the Energy Sector

EPA applies Strategic Environmental Assessments(SEAs) to predict and evaluate the environmental implications of a plan in order to identify areas of concern and establish best environmental practices.

Different forms of assessments includes:

- Ecological impact assessment
- Environmental health impact assessment
- Hazard and risk impact assessment
- Noise impact assessment
- Social impact assessment
- Water quality impact assessment
- Air quality impact assessment



Environmental Management

- Environmental issues generally addressed by environmental policy include (but are not limited to)
 - air and water pollution,
 - waste management,
 - ecosystem management,



New Environmental Policy Instruments (NEPIs)

Managing the environment;

NEPIs have begun to be adopted by advanced societies in recent years.

NEPIs are said to have largely replaced the dependence on, and requirement for, environmental regulation. Instruments of environmental policy include;

New Environmental Policy Instruments

Cont.

- Landfill Tax
- Climate Change Levy
- Eco-taxes,
- Tradable permits,
- Voluntary agreements
- Information and Awareness schemes
- 100% Capital Allowances Scheme

New Environmental Policy Instruments

Cont..

- **The Landfill Tax** is a charge on the disposal of waste to landfill. It aims to encourage waste producers to produce less waste, to use alternative methods of waste disposal, and to recycle.
- **The Climate Change Levy** is a charge on energy use and applies to all parts of the business sector. The aim of the levy is to encourage business to develop and use
- energy efficient technologies

New Environmental Policy Instruments

Cont...

- Some businesses can agree to improve energy efficiency or reduce emissions through Climate Change Agreements (CCAs) in return for a discount to the levy.
- It has been criticised by parts of business and some environmental groups who would prefer a carbon tax.

New Environmental Policy Instruments

Cont....

- **The 100% Capital Allowances Scheme** is available for companies investing in energy efficiency technologies.
- It is a tax relief on investment in a range of Government approved energy-saving equipment.
- Capital expenditure can normally be deducted from tax over a period of time

NEPI in Practice

- **The UK Emission Trading Scheme** is a scheme where participants can trade with greenhouse gas emission allocations.
- A total acceptable emissions level for all participants is determined, which is then divided into units and distributed among them.
- Allowances can be bought and sold to meet emission targets.

NEPI in Practice Cont.

- Participants who reduce emissions and have surplus allowances can sell their permits to others that find emissions reduction more expensive or difficult.
- A similar EU-wide emission trading scheme commenced in 2005.

NEPI in Practice Cont..

- **The Renewable Obligation** requires electricity suppliers to supply a specific proportion of their electricity from renewable sources such as wind or wave power.
- Again, credits can be traded to encourage the uptake of renewable energy.

Energy and Environment

- The impact of the production and use of energy on the environment is undeniable and varying in its degrees.
- The exploitation of biomass for energy purposes results in deforestation, while the use of fossil based fuels contributes to carbon dioxide emissions.
- The use of inferior cooking equipment also has negative health impacts

Energy and Environment

- Production and transportation of crude oil and petroleum products and the flaring of natural gas associated with petroleum production have associated environmental risks.

Ghana's response- Energy and Environment

- Promote the use of environmentally friendly energy supply sources such as renewable energy (solar, wind, waste) in the energy supply mix of the country;
- Encourage a shift from oil to gas wherever gas is a technically feasible alternative;
- Promote the use of improved wood fuel burning equipment for cooking in households and other commercial activities;

Ghana's response- Energy and Environment

- Support and actively participate in international efforts and cooperate with international organisations that seek to ensure sustainable delivery of energy to mitigate negative environmental impacts and climate change

Ghana's response- Energy and Environment

- Encourage and enable all relevant entities engaged in activities in the energy sector to explore and access international environmental financial mechanisms and markets to overcome investment, technology and other relevant barriers

Ghana's response- Energy and Environment

- Ensure effective disposal of all hazardous substances and materials associated with the
- production, transportation and use of energy; and Facilitate environmental protection awareness programmes

International framework

- United Nations Framework Convention on Climate Change
 - 1992 - The Kyoto Protocol
 - 2007 - Bali Conference
 - 2008 – Warsaw Conference
 - 2009 – Copenhagen Conference

Regional / UK Framework

- European Union
 - Emissions Trading Scheme (EU ETS)
 - Carbon Capture Scheme (CCS) Directive – draft in EU parliament – Committee vote 7th October 2008
 - Politics now at work
- UK Government
 - 2008 Energy Bill (Chapter 3 = CCS)
 - Regulation in drafting (BERR and Crown Estate)

The Future-Sustainable Energy

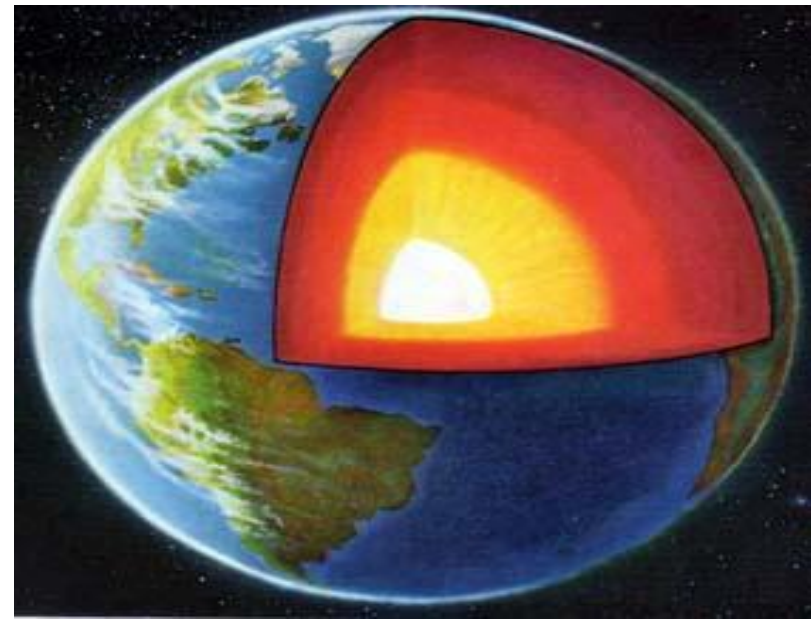
Sustainable energy is the provision of energy that meets the needs of the present without compromising the ability of future generations to meet their needs.

Sustainable energy sources include all renewable energy sources, such as hydroelectricity, solar energy, wind energy,

The Future-Sustainable Energy

Wave power,
Geothermal energy,
Bioenergy, and
Tidal power.

It usually also includes technologies designed to improve energy efficiency.



What is Causing Climate Change

Air Emissions

- ❑ The main sources of air emissions (continuous or non-continuous) resulting from offshore activities include:
 - Combustion sources from power and heat generation,
 - Fugitive emissions
 - Use of compressors,
 - Pumps, and reciprocating engines (boilers, turbines, and other engines) on offshore facilities including support and supply vessels and helicopters;
 - Emissions resulting from flaring and venting of hydrocarbons

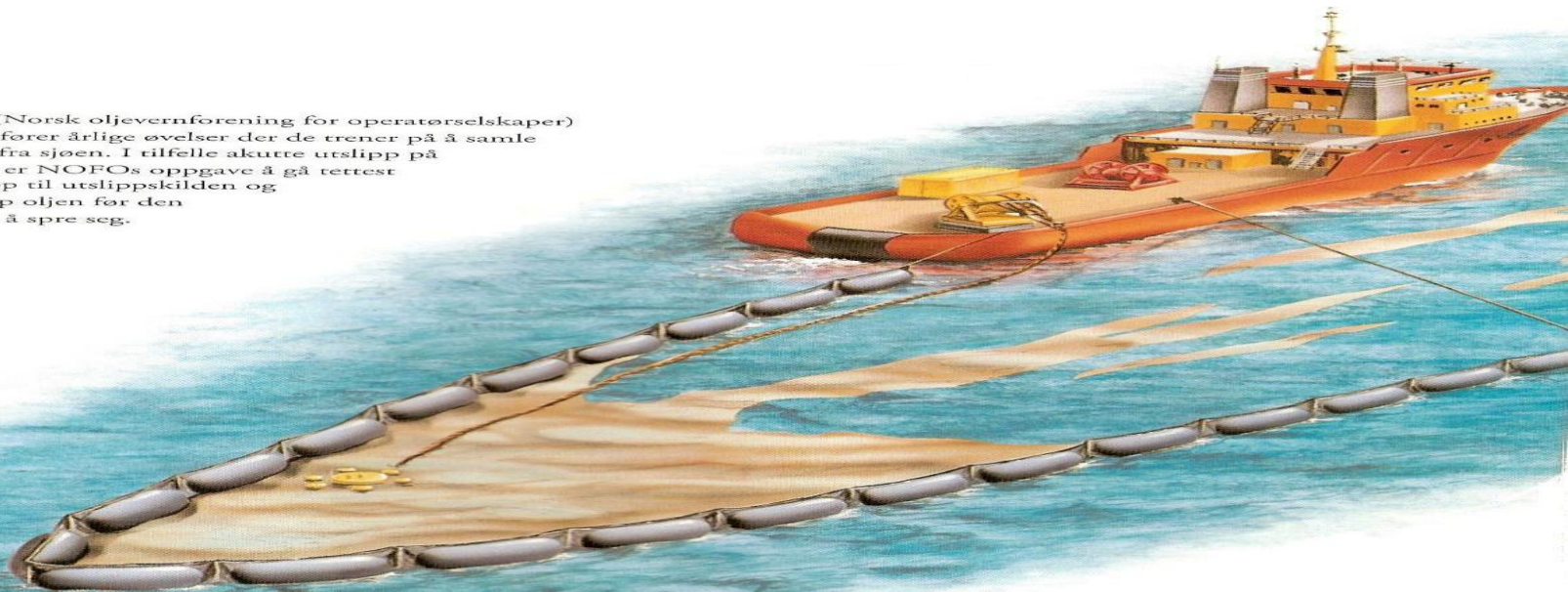


What is Causing Climate Change

Oil Spillage

- According to Energy Information Administration (EIA), nearly 2% – 3% of all extracted oil is lost during extraction and transportation.

NOFO (Norsk oljevernforening for operatørselskaper) gjennomfører årlige øvelser der de trener på å samle opp olje fra sjøen. I tilfelle akutte utslipp på sokkelen er NOFOs oppgave å gå tettest mulig opp til utslippskilden og samle opp oljen før den får tid til å spre seg.



Mitigating Climate Change - Sustainable Energy

Renewable energy and energy efficiency are sometimes said to be the “twin pillars” of sustainable energy policy.

Both resources must be developed in order to stabilize and reduce Carbon dioxide emissions.

Mitigating Climate Change - Sustainable Energy

- Renewable energy (and energy efficiency) are no longer niche sectors that are promoted only by governments and environmentalists.
- The increased levels of investment and the fact that much of the capital is coming from more conventional financial actors suggest that sustainable energy options are now becoming mainstream.

The Solutions - Alternative Sources of Energy

HydroElectricity



Pinnacles Hydro, Virginia, USA



Lake Manapouri New Zealand



Hoover Dam, USA

The Solutions - Alternative Sources

Solar Energy

Solar water heating



Solar Two - Daguerre Point



Photovoltaic cells - Nellis Air Force Base

The Solutions - Alternative Sources of Energy

Wind



Liaodong Bay, China



Copenhagen, Denmark

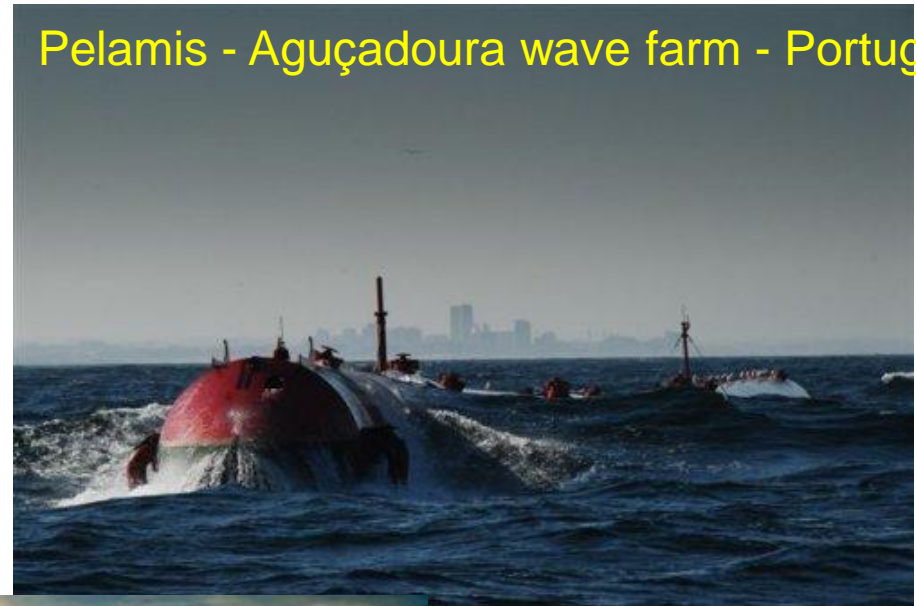


Tidal & wave

240MW La Rance Estuary, France



Pelamis - Aguçadoura wave farm - Portugal

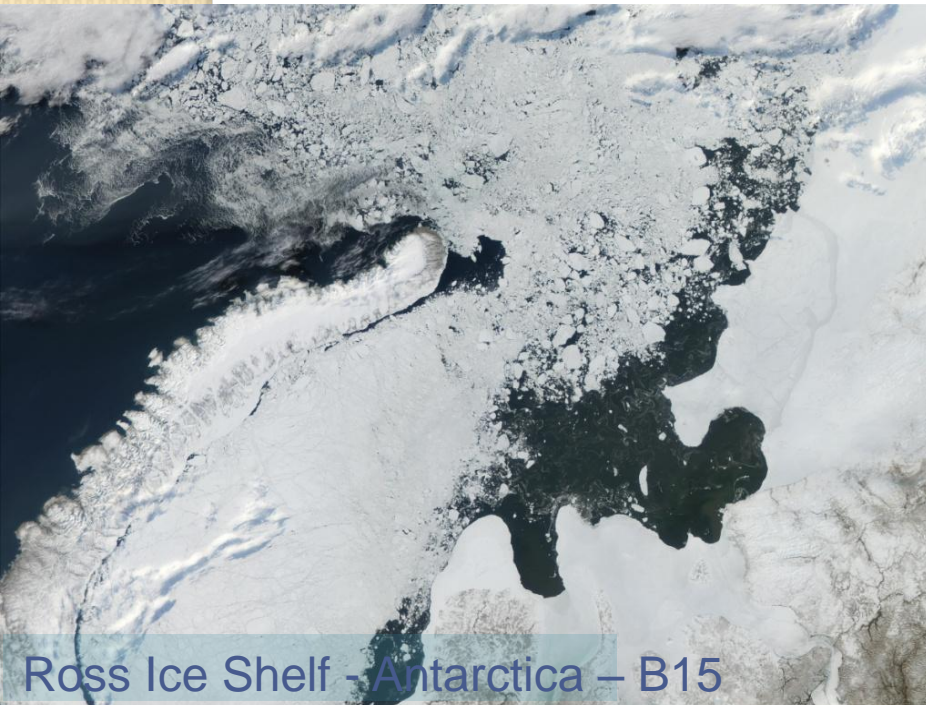


Underwater turbines

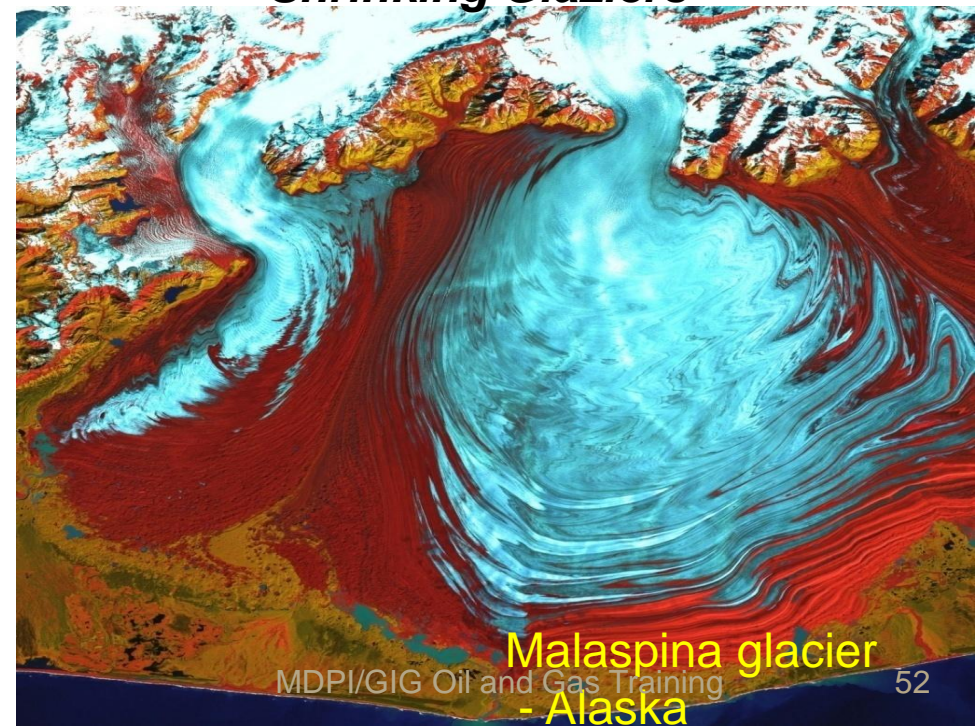
Effects of Oil and Gas on Environment - Climate Change

- ❖ Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures
- ❖ Widespread melting of snow and ice and rising global average sea level

Disintegrating Ice



Shrinking Glaziers

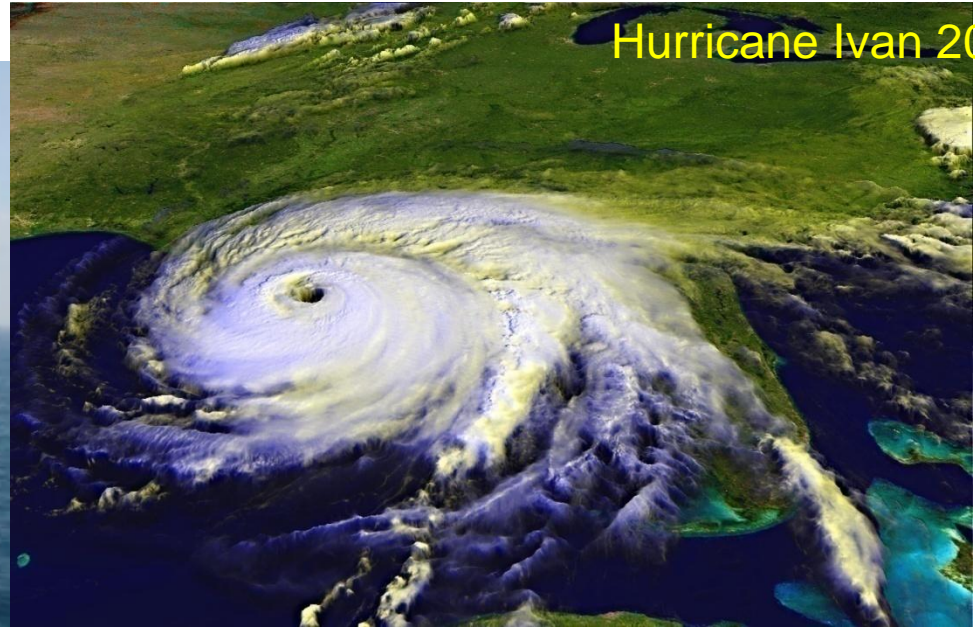


The Problem - Global Warming and Climate Change

Hurricanes



Hurricane Ivan 2005 – Murphy Medusa



Hurricane Ivan 2005



Hurricane Ivan 2005 – EnSCO 64

Waste Management Principles

- ❑ Pollution prevention and waste minimization eliminate the production of waste through:
 - Process Changes

- ❑ 4R's:
 - Reduce, Reuse, Recycle and Recover



The Solutions – Getting rid of the CO₂

Don't produce the CO₂ at all

- Improving the fuel efficiency of cars
- Walking or cycling on short journeys
- Using condensing boilers to power central heating
- Improving building insulation
- Changing to low-energy light bulbs
-etc etc etc



Carbon Offset Schemes

- Example – BP TargetNeutral
 - Composting facility in Australia
 - Wind Energy in India
 - Livestock operations - Mexico, Chile, Argentina & Brazil
- Example – ClimateCare
 - Human-powered water pumps
 - 1 pump = 0.47 tonnes CO₂ per year saved

Carbon Offset Schemes

- Converting crop/animal waste into bio-fuel (instead of burning it)
- Efficient light bulbs
 - UK 0.43 kg CO₂ / KWh
 - Kazakhstan 1.20 kg CO₂ / KW

Understand the Emerging Market

Climate Change 'Interest' Index

Critical to our future

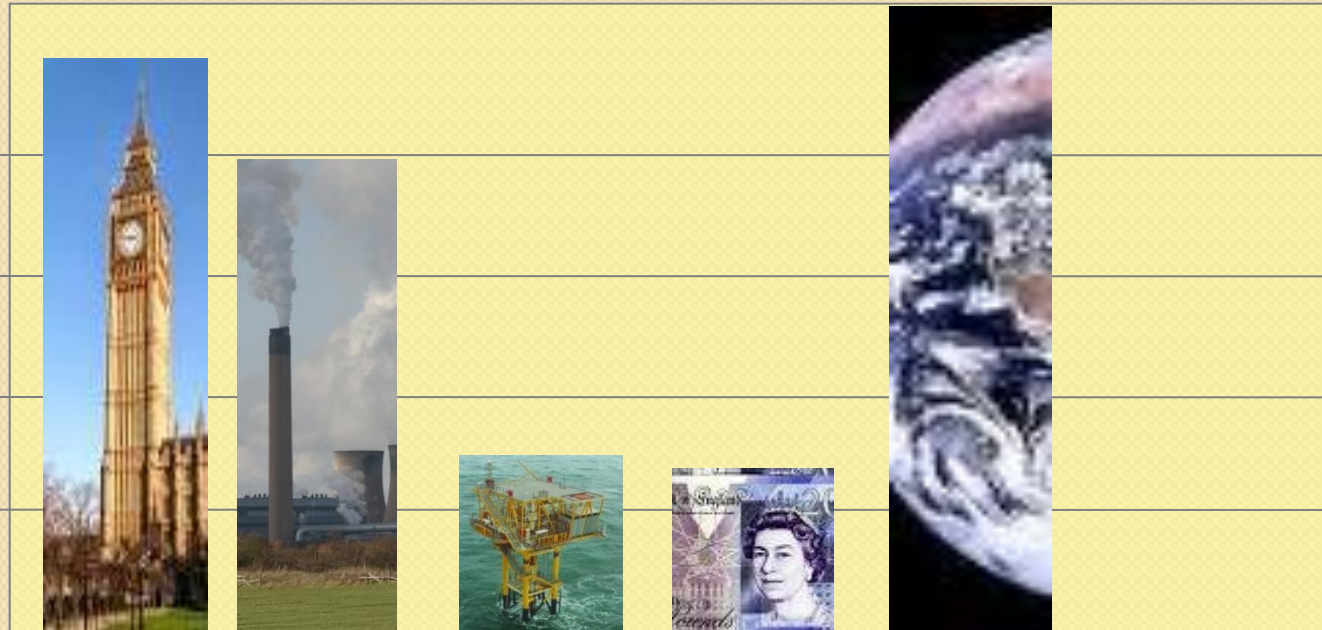
Important but ...

More study required

Let's wait & see

I'm a bit busy

What is CCS?



Government

Power

Oil & Gas

Banks

NGOs

Public Opinion

Pros and cons of renewables

- Consider
 - Solar
 - Wind
 - Wave
 - Hydro
 - Biomass
- What are the
 - Advantages
 - Disadvantages
 - Issues associated with this source

Gas Flaring in Perspective

- Associated gas flaring is one of the most challenging energy and environmental problems facing the world today.

Gas Flaring in Perspective

Size of the problem

- 150 billion cubic meters per year of flared gas is roughly equivalent to ...
 - Gas use in all US residences for a year
 - 5% of global natural gas production
 - 23% of US natural gas use
 - 30% of EU natural gas use
 - US\$10 Billion lost revenue at \$2.00 per MMBtu
 - 2.4 Million barrels of oil equivalent per day

Gas Flaring in Perspective

Climate impact

- 400 million tonnes per year of CO₂ is roughly equivalent to ...
- Annual emissions from 77 Million cars (34% of US fleet)
- 2% of global CO₂ emissions from energy sources
- US\$6 Billion carbon credit value at \$15.00 per Metric Tonne

Anti Flaring - *Policy Solutions*

- A lack of technology solutions is not the problem; gas flaring can be dealt with today through a variety of existing technologies at reasonable cost.
- Power generation
- Gas re-injection to enhance oil recovery,
- Gathering and processing,
- Pipeline development,
- Liquefied Natural Gas (LNG)

Gas Flaring: A Cycle of Waste



Figure 3: Cycle of waste

Source: GE Energy

Gas Flaring: A Cycle of Waste



Nigerian Gas Flaring by Company 2000-2009

Billion Cubic Meters per Year

Company	'00-'03	'03-'05	'06	'07	'08	'09
Grand Total	24.8	25.7	23.0	19.0	17.8	14.9
Shell (SPDC)	7.9	7.1	4.6	2.7	2.8	2.1
ExxonMobil	3.6	5.1	5.7	5.3	3.8	4.1
Chevron	5.1	4.0	5.6	4.7	4.6	3.4
Total	1.2	2.5	1.8	1.0	1.0	1.0
ENI (NAOC)	5.5	4.7	3.1	3.1	2.7	2.1
Addax-Sinopec	0.8	0.9	1.3	1.7	2.1	1.6
Others	0.7	1.4	0.8	0.6	0.8	0.5

Figure 12: Nigerian Gas Flaring by company 2000-2008

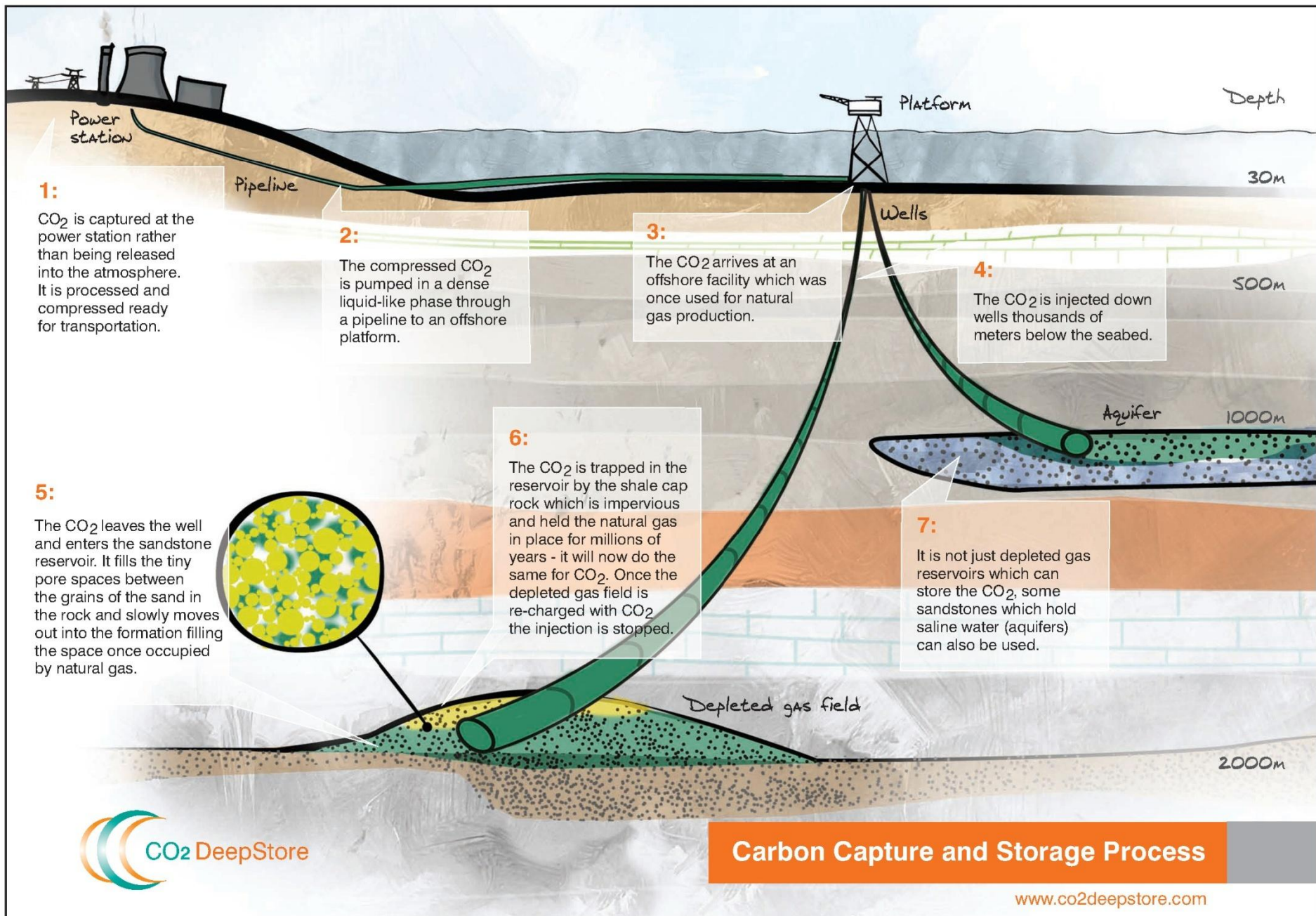
Source: Nigerian National Petroleum Corporation (NNPC) statistical bulletins

International Commitments Need Strengthening

Flare reduction investments can have a meaningful impact on the quality of life and economic progress.

International organizations are involved in active campaigns such as;

- World Bank's Global Gas Flaring Reduction Initiative (GGFR)
- International Energy Agency (IEA),
- G8, etc



Carbon Capture and Storage Process

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renewable energies like switchgrass and wood chips. Not to mention looking at ways to help all of us be more energy-efficient. Though it's true that coal is the most economical source right now, common sense says that more options mean more ways to make our world better.

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