KUALA LUMPUR 2012 WORLD GAS CONFERENCE

IGU

25th world gas conference

"Gas: Sustaining Future Global Growth"

FORECASTING IMPACT OF GAS ON CLIMATE CHANGE

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7 June 2012

F1 Room, Petronas 3

Patron

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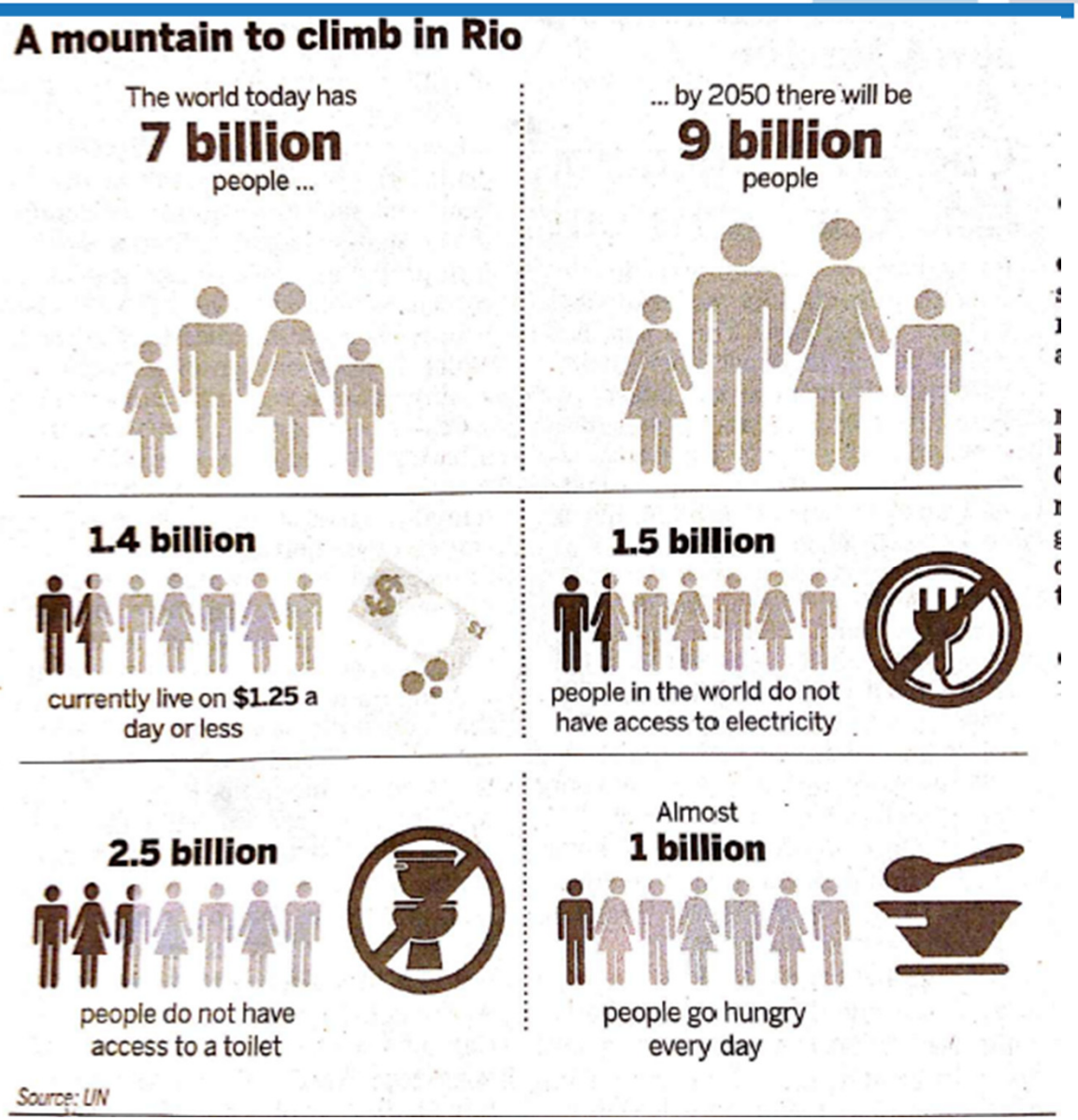
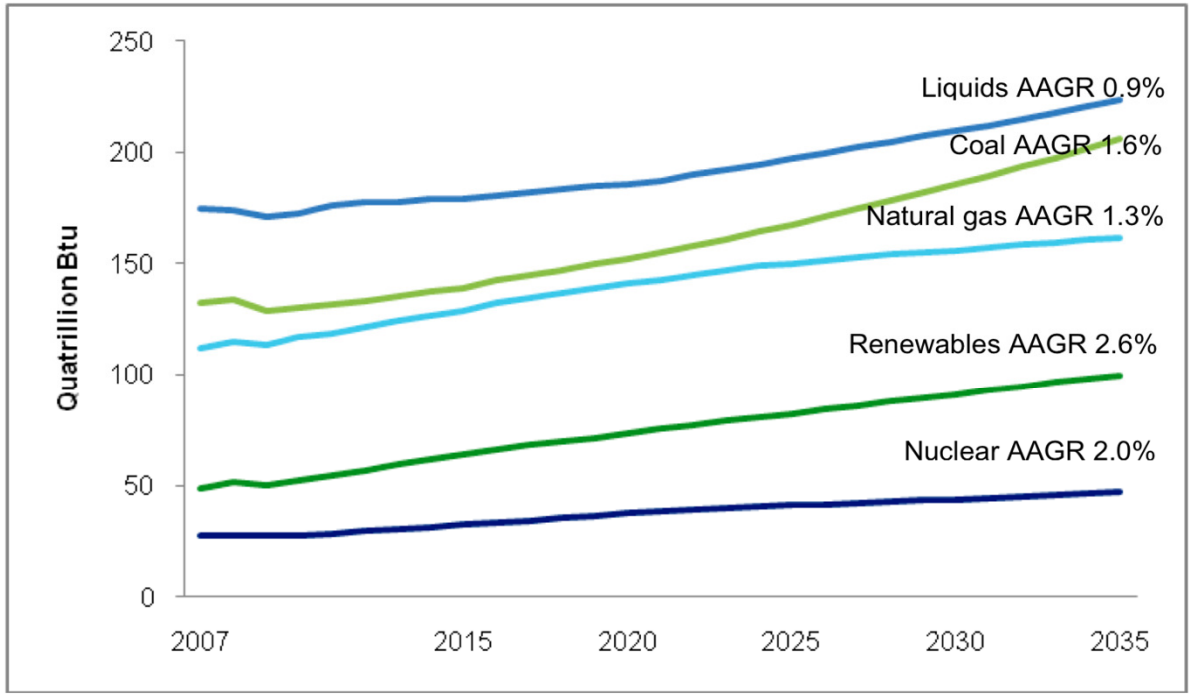
reimagining energy

Brave new world



OGI growth and new technology

Figure 3.16 Projection of global demand for energy by sources



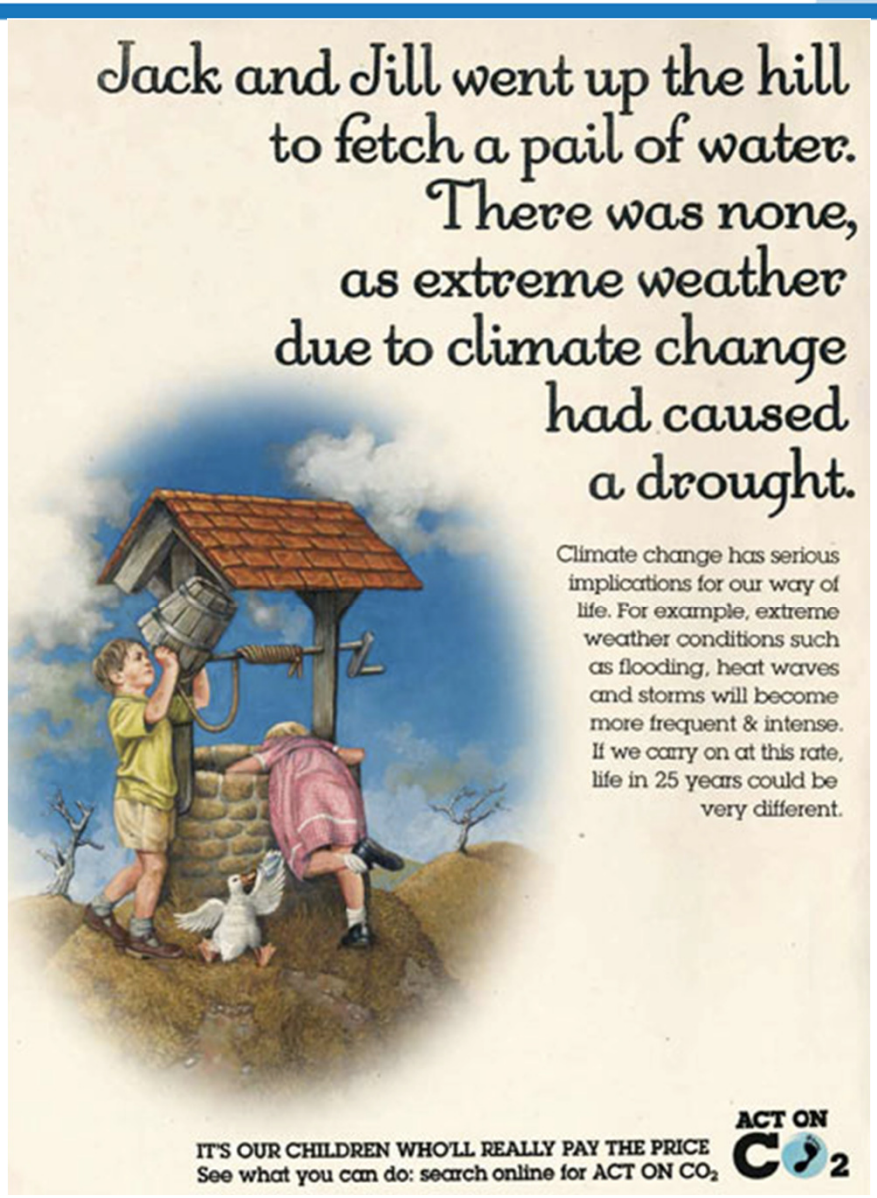
Source: *U.S. Energy Information Administration (2010).*

- Demand for O&G products:
  - **technological frontier challenge**: deep water sources, shale beds, tar sands, coal bed methane, coal to liquid, geo-engineering (managing atmospheric brown clouds) etc
  - **Climate change and environmental sustainability challenge**

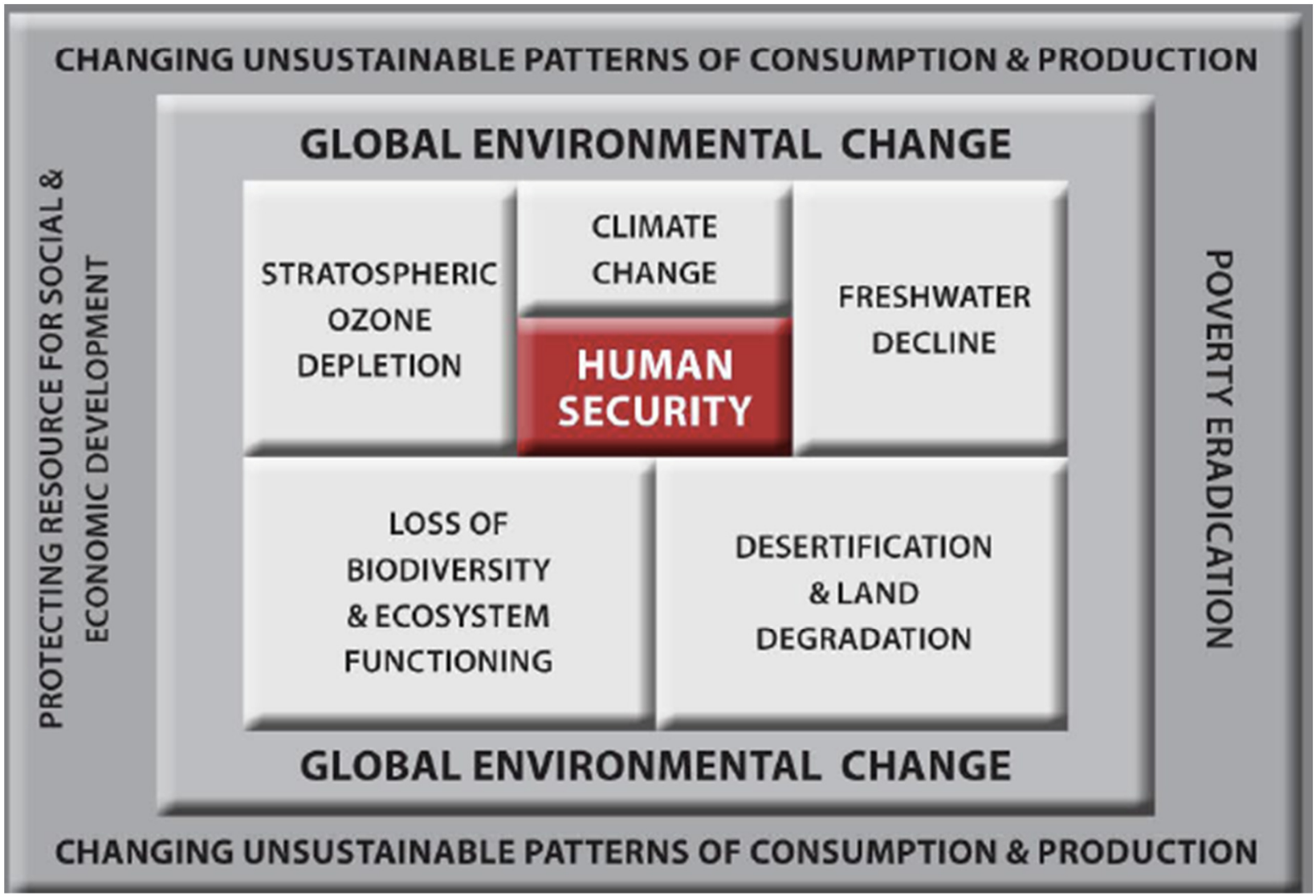
The second gas revolution?

- Unconventional sources
- ICT enabled extraction techniques
- Clean
- Mobile
- Fungible

Impact


Jack and Jill went up the hill
to fetch a pail of water.
There was none,
as extreme weather
due to climate change
had caused
a drought.
Climate change has serious implications for our way of life. For example, extreme weather conditions such as flooding, heat waves and storms will become more frequent & intense. If we carry on at this rate, life in 25 years could be very different.
IT'S OUR CHILDREN WHO'LL REALLY PAY THE PRICE
See what you can do: search online for ACT ON CO2
ACT ON CO2

Climate change refers to an ongoing trend of changes in the earth's general weather conditions as a result of an average rise in the temperature of the earth's surface often referred to as global warming. This rise in the average global temperature is held primarily to be due to the increased concentration of greenhouse gases (GHGs) in the atmosphere that are emitted by human activities. These gases intensify a natural phenomenon called the "greenhouse effect" by forming an insulating layer in the atmosphere that reduces the amount of the sun's heat that radiates back into space and therefore has the effect of making the earth warmer.

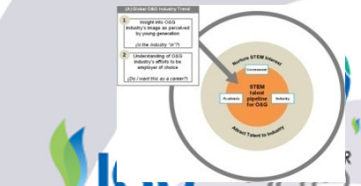

CHANGING UNSUSTAINABLE PATTERNS OF CONSUMPTION & PRODUCTION
GLOBAL ENVIRONMENTAL CHANGE
PROTECTING RESOURCE FOR SOCIAL & ECONOMIC DEVELOPMENT
STRATOSPHERIC OZONE DEPLETION
CLIMATE CHANGE
FRESHWATER DECLINE
HUMAN SECURITY
LOSS OF BIODIVERSITY & ECOSYSTEM FUNCTIONING
DESERTIFICATION & LAND DEGRADATION
POVERTY ERADICATION
GLOBAL ENVIRONMENTAL CHANGE
CHANGING UNSUSTAINABLE PATTERNS OF CONSUMPTION & PRODUCTION

Engaging with climate change

- Effectively manage inevitable climate change impacts through interventions that build and sustain social, economic and environmental resilience and emergency response capacity.

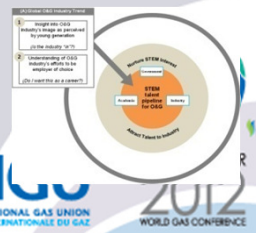
- Contribute timeously to the global effort to stabilize greenhouse gas (GHG) concentrations in the atmosphere to avoid dangerous anthropogenic interference with the climate system and enable sustainable economic, social and environmental development

- Company policies should seek to be consistent with national legislation, the Millennium Declaration and the United Nations Framework Convention on Climate Change.

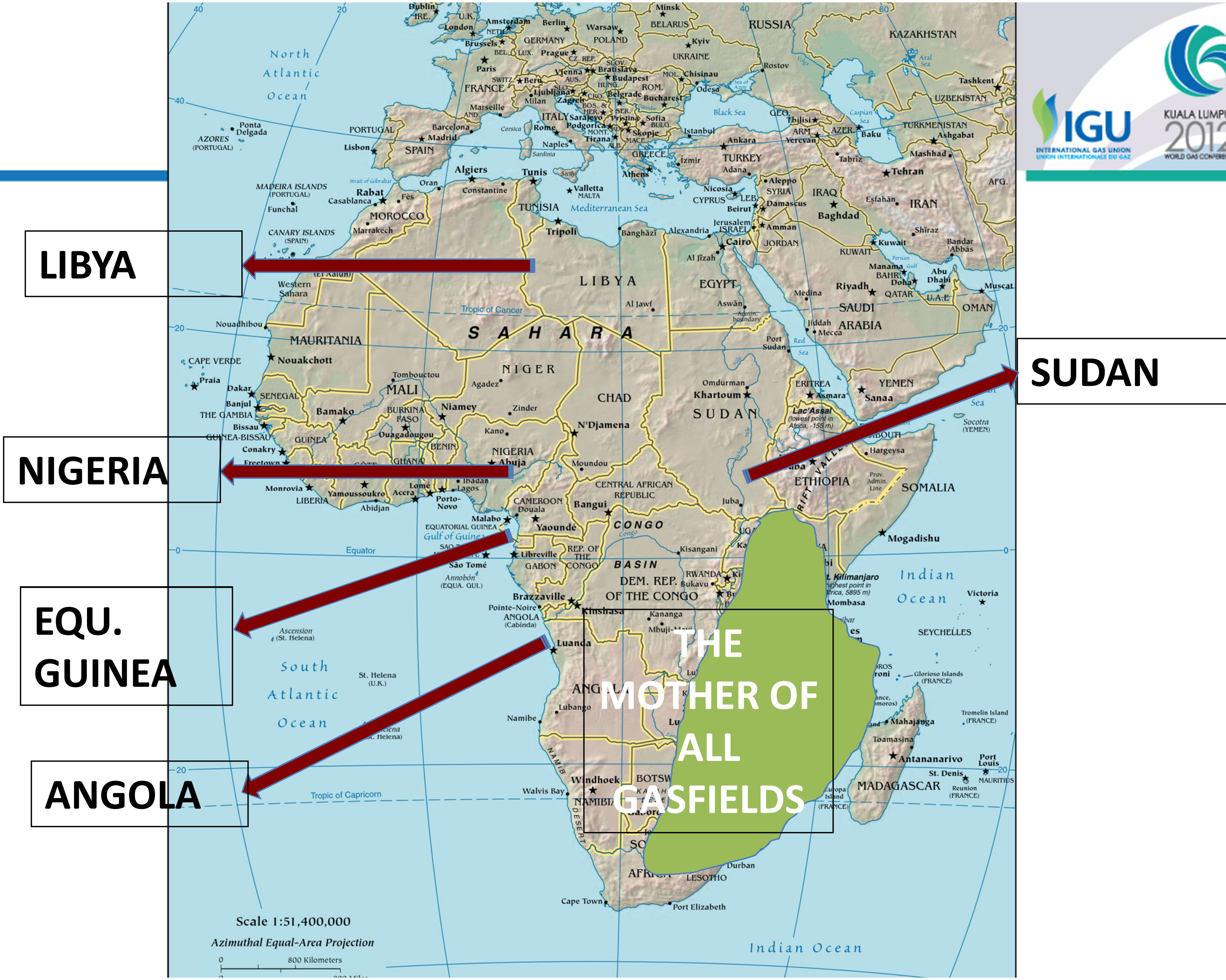


- Develop a risk-based process to identify and prioritise short- and medium-term adaptation interventions
- Sectors of concern: energy, industry, water, agriculture and forestry, health, biodiversity and human settlements
- Mitigation:
  - Emission reduction outcomes based on mitigation potential, best available mitigation options, science, evidence and a full assessment of the costs and benefits
  - Carbon budget approach in relevant sectors and, where appropriate, translating carbon budgets into company emission reduction outcomes
  - Develop a Greenhouse Gas Inventory and Monitoring and Evaluation System to study impact of mitigation measures

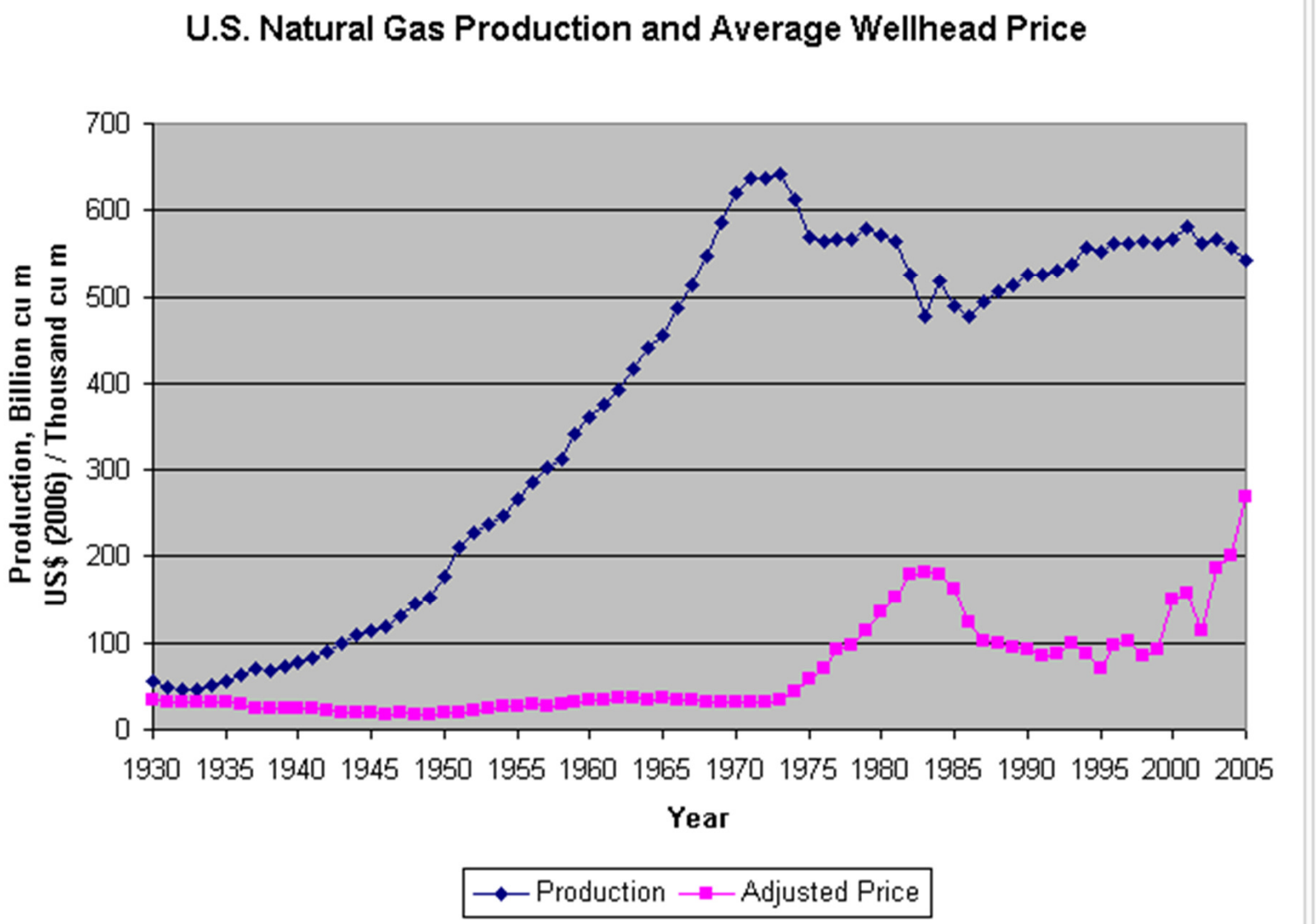
Industry challenge



- The industry usually viewed negatively as **environmentally unfriendly** and **hazardous**
- Global **O&G industry outlook is positive** as the energy demand projected to increase
- **Beyond CSR**


LIBYA
SUDAN
NIGERIA
EQU. GUINEA
ANGOLA
THE MOTHER OF ALL GASFIELDS
North Atlantic Ocean
South Atlantic Ocean
Indian Ocean
Mediterranean Sea
S A H A R A
LIBYA
EGYPT
SUDAN
CHAD
NIGER
MALI
MAURITANIA
MOROCCO
TUNISIA
NIGERIA
ETHIOPIA
SOMALIA
CONGO BASIN
DEM. REP. OF THE CONGO
MADAGASCAR
SAUDI ARABIA
TURKEY
IRAN
IRAQ
RUSSIA
KAZAKHSTAN
Tropic of Cancer
Equator
Tropic of Capricorn
Scale 1:51,400,000
Azimuthal Equal-Area Projection
800 Kilometers

It's a gas, right?



It’s a gas, right?

Natural gas prices at the Henry Hub in US Dollars per MMBtu for the 2000-2010 decade.

Dr Piers Corbyn - astrophysicist

The main periodical solar activity effect - the largest observed periodicity present in world temperature data – follows a 22 year. Hence for about half the time, the 11 year cycle of solar activity of particles, sunspots and radiation will move with temperature and half the time move against it.

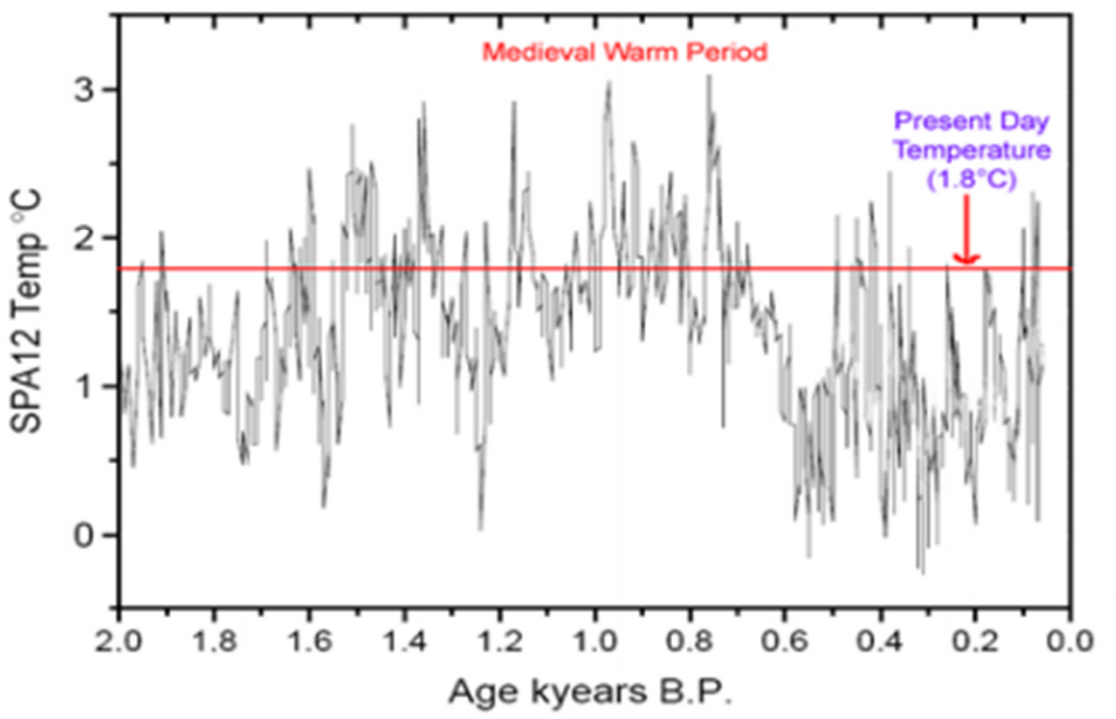
Climate change advocates choose time spans where the two move in opposite directions and ignore demonstrated correlations on longer time spans.

Scientists who research, understand and apply sun-earth magnetic and particle effects in probably skilled weather and climate forecasting are marginalized.

CO^2 based climate and seasonal weather forecasts on the other hand show no skill, have been abysmally incorrect for a decade and have got worse in the last few years.

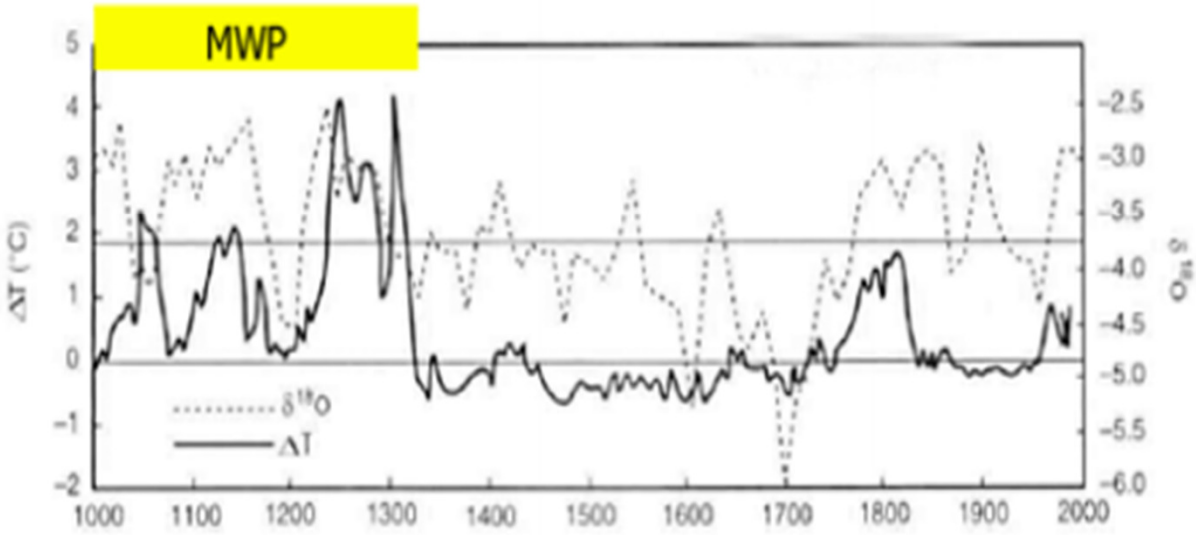
Spannagel Cave, Central Austrian Alps

Mangini *et al.* (2005) developed a highly-resolved 2000-year record of temperature with better than decadal resolution from a stalagmite recovered from Spannagel Cave in the Central Alps of Austria (47.09°N, 11.67°E). The highest temperatures of the past two millennia occurred during the Medieval Warm Period (AD 800-1300) and were "slightly higher than those of the top section of the stalagmite (1950) and higher than the present-day temperature." In fact, at three different points during the medieval warm period, their data indicate temperature spikes in excess of 1°C above present (1995-1998) temperatures.



Cold Air Cave, Makapansgat Valley, South Africa

Tyson *et al.* (2000) reported that maximum annual air temperatures in the vicinity of Cold Air Cave (24°1'S, 29°11'E) in the Makapansgat Valley of South Africa were inferred from a relationship between color variations in banded growth-layer laminations of a well-dated stalagmite and the air temperature of a surrounding 49-station climatological network developed over the period 1981-1995, as well as from a quasi-decadal-resolution record of oxygen and carbon stable isotopes. The medieval warm period (AD 1000-1325) was as much as 3-4°C warmer than the Current Warm Period (AD 1961-1990 mean).



Makapansgat Valley proxy temperature reconstruction adapted from Tyson et al. MWP is represented by the yellow highlighted bar at the top of the graph.

What does this all mean?

Premise	Implications
1.Climate change is real	1. **Develop a broad set of actions**
2.The Anthropocene Age is real	2. **Focus on mitigating human interactions**
3. Renewables can fully substitute for fossil fuels	3. **Drive PV, wind turbine, hydropower, geothermal ….**
4.Gas is a responsible alternative	4.Design environmentally acceptable extraction methods