Prof. Dr. Uğur Atikol

MENG449 INTRODUCTION TO ENERGY MANAGEMENT

Chapter 1 - Introduction

Coverage:

- Course grading and NG policies
- Why do we need *Energy Management*?
- Total primary energy supply in the world
- Consequences of fossil fuel use
  - World energy resources
  - Environmental problems
  - Economics
- Objectives of *Energy Management*
- Energy sustainability

Grading and NG policies

- Mid-Term (25%)
- Quizes (10%)
- Term Project (25%)
- Final (40%)

NG Policy

- Students who **DO NOT** attend any **two** of the assessment activities (such as quizes, mid-term exam, etc.) and/or have an attendance below 70% will be given NG (Nil Grade).
- The students who fails to get a **minimum of 50%** from the **term project** will be given NG.

Why do we need Energy Management?

Economics

- Increasing profitability
- Competitiveness of businesses

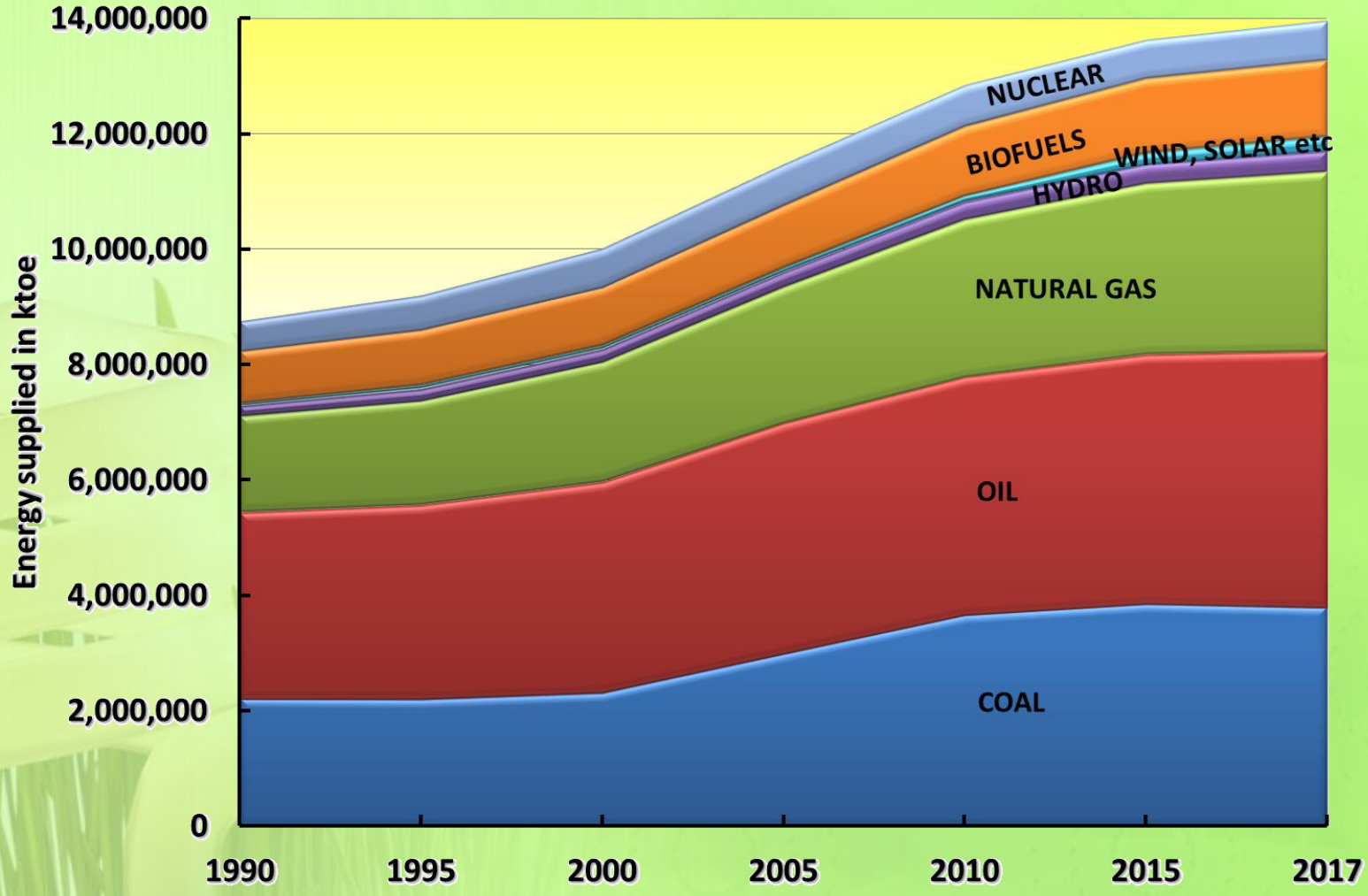
National Interests

- Preserving resources
- Increasing competitiveness
- Increasing national security

Reducing Emissions

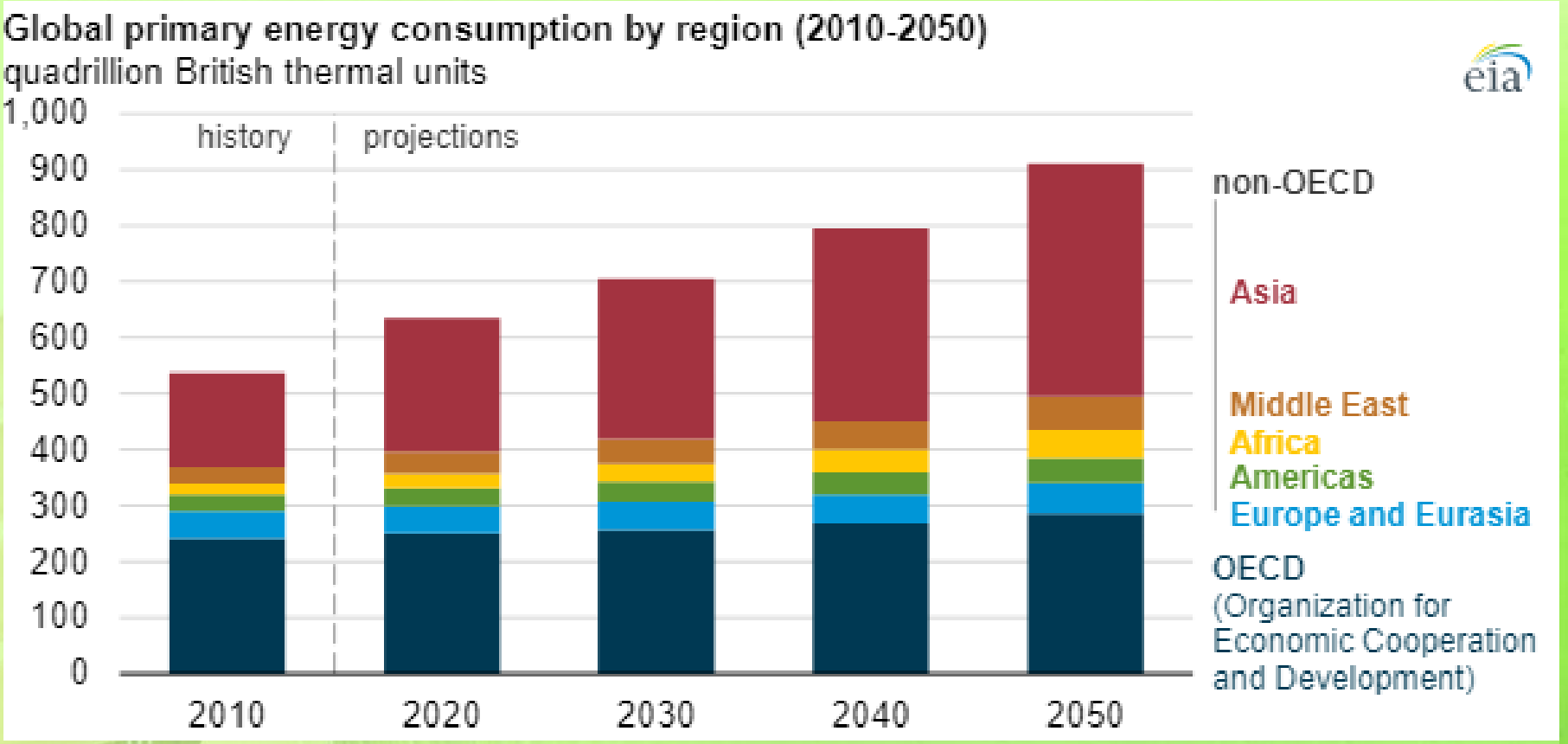
- Reducing global warming
- Reducing acid rains
- Reducing depletion of ozone layer

Total primary energy supply (TPES) by source, World 1990-2017



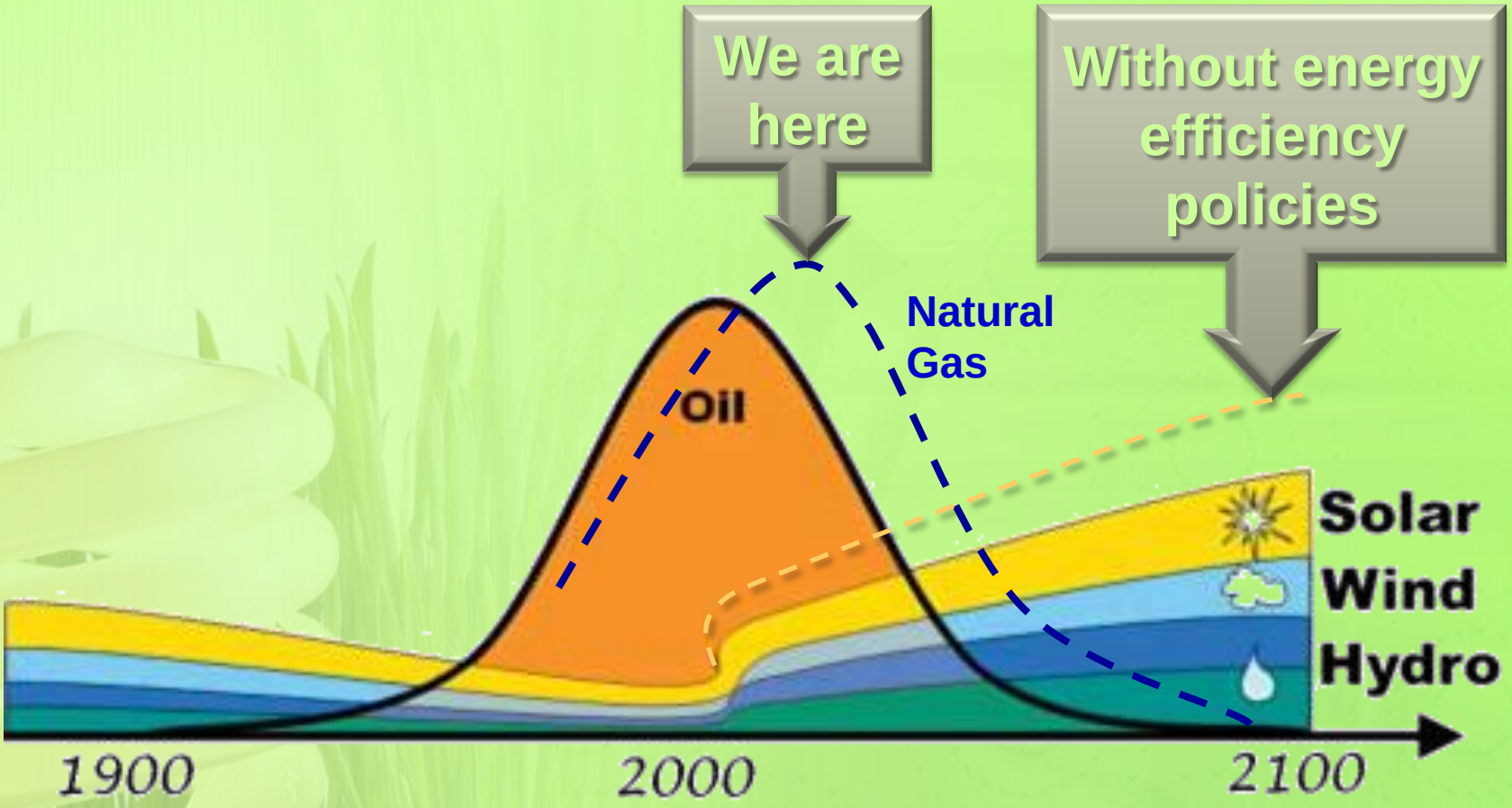
Source: https://www.iea.org/data-and-statistics

...and that growth will continue

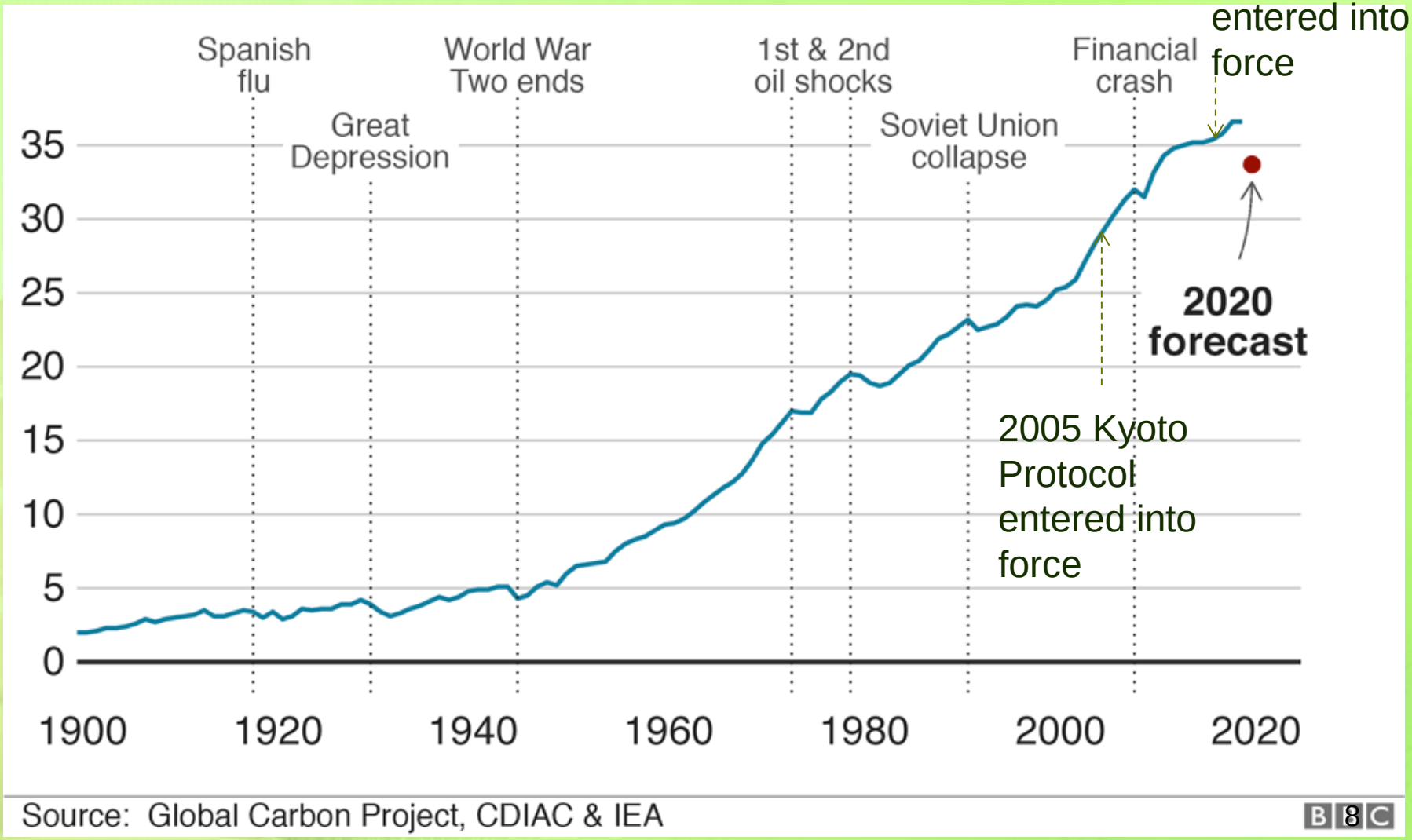


Source: U.S. Energy Information Administration, *International Energy Outlook 2019* Reference case

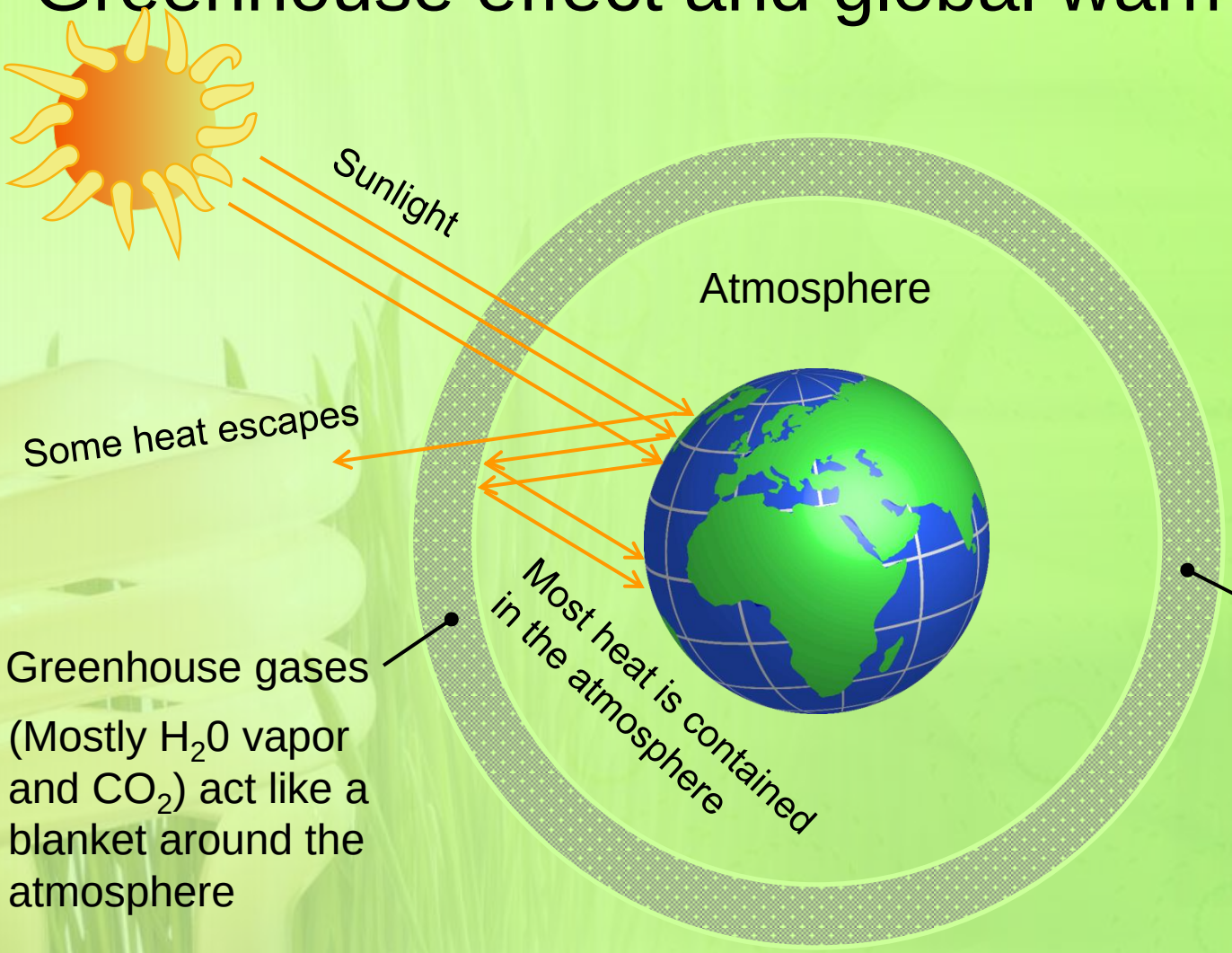
World energy reserves: *petroleum and natural gas*



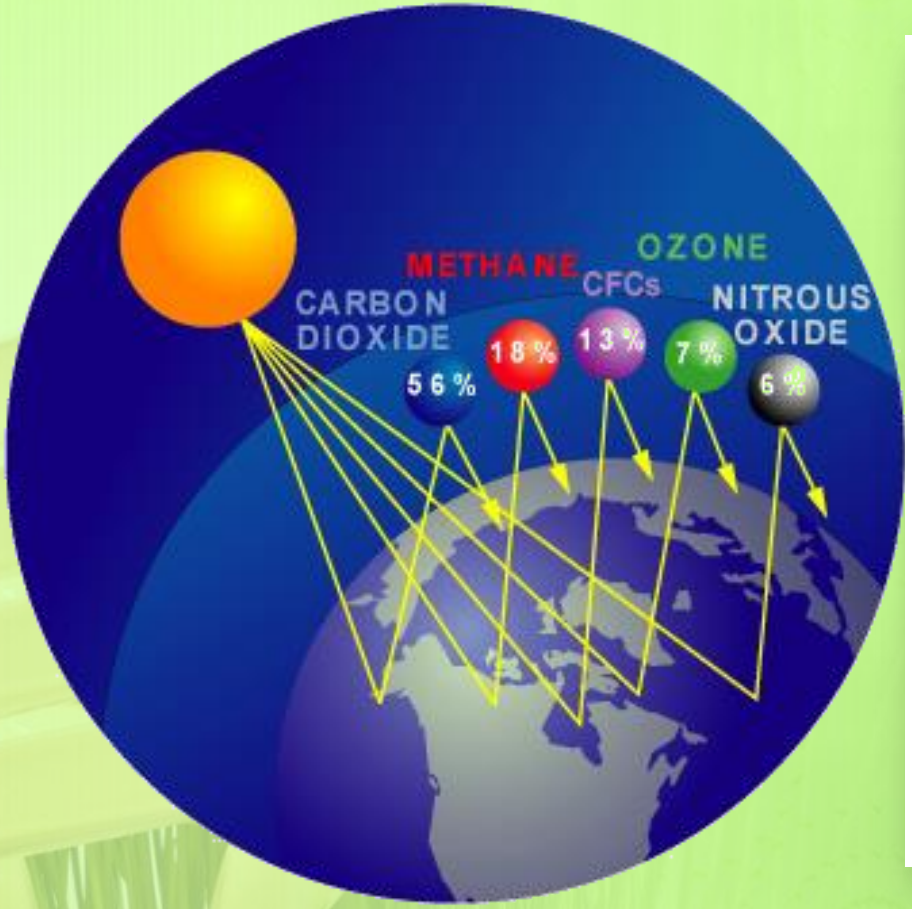
Global CO_2 emissions, 1900-present (Billion tonnes of CO_2 per year)

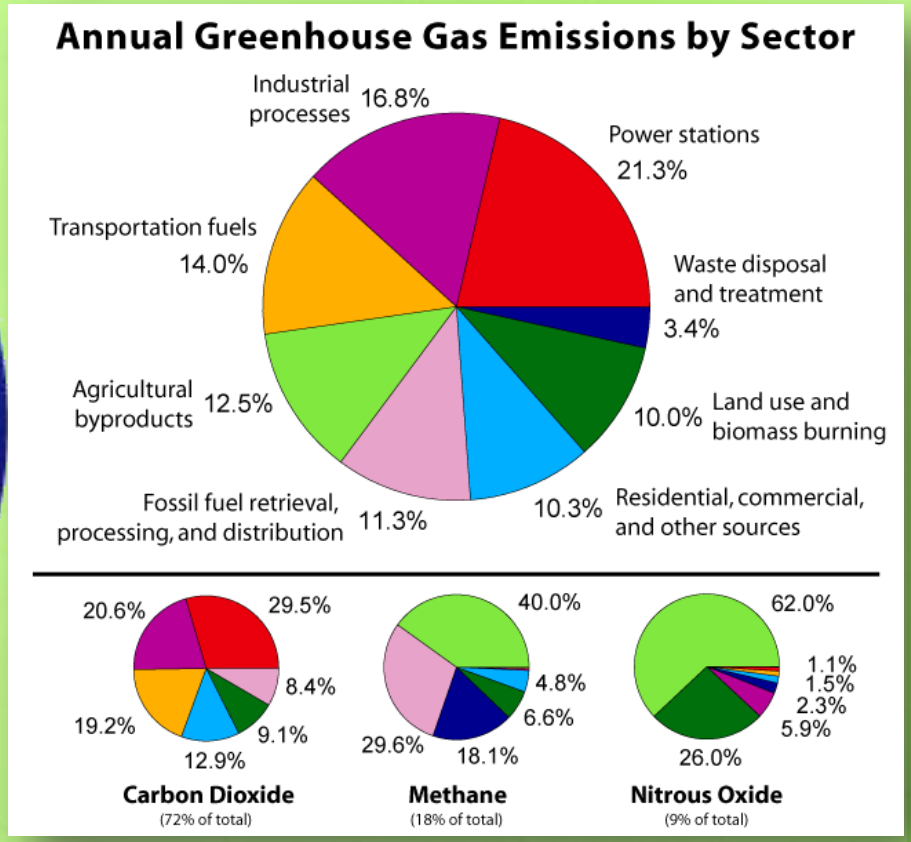


Greenhouse effect and global warming



Human-Produced Greenhouse Gases





Consequences of global warming

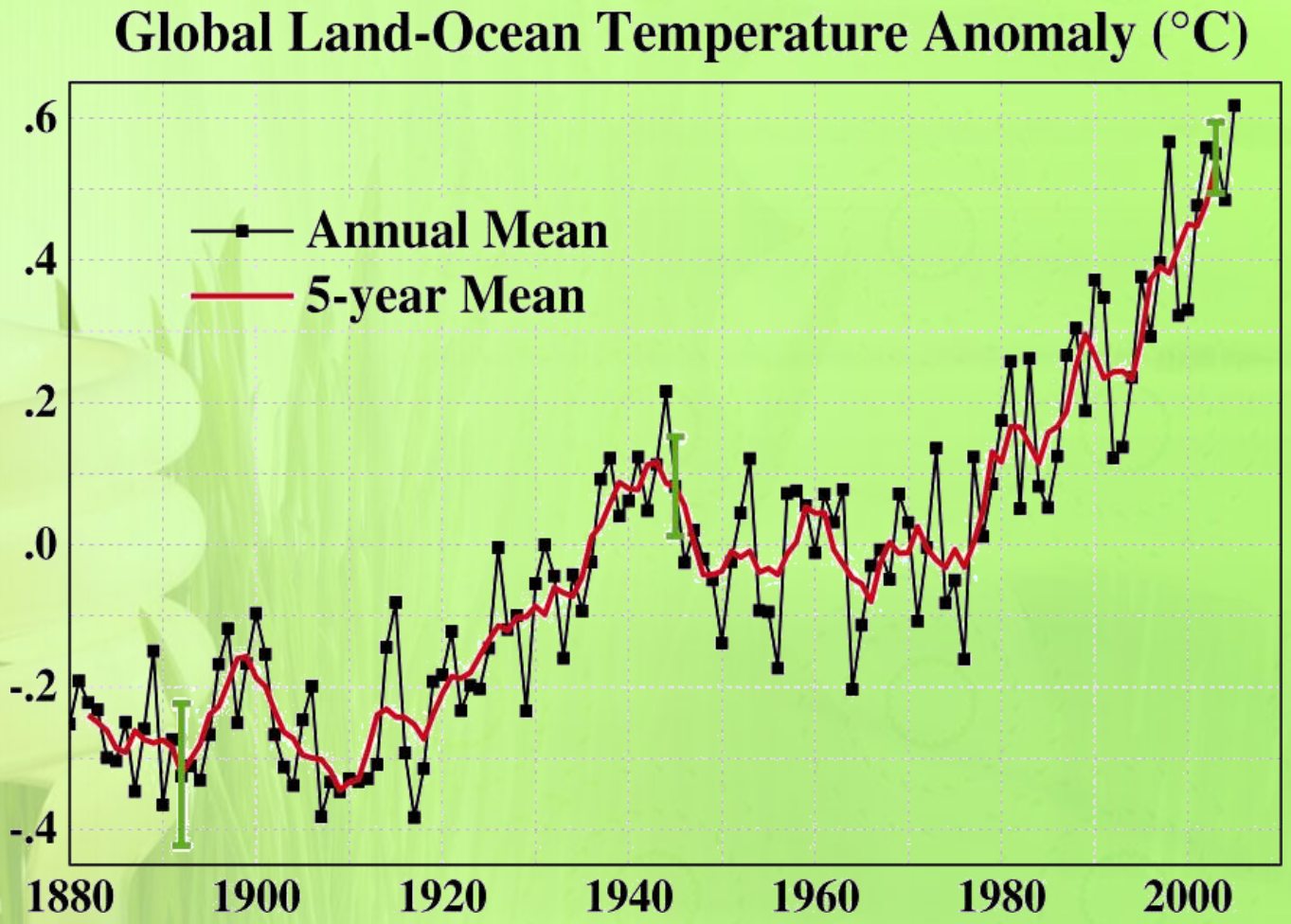
Rising earth temperature

- Land and ocean temperature increasing
- Sea level rising
- Glaciers melting

Human health risks

- Reduced food security
- Increasing pest and insect population
- Respiratory allergies, asthma

Global annual surface temperatures relative to 1951-1980 mean temperatures

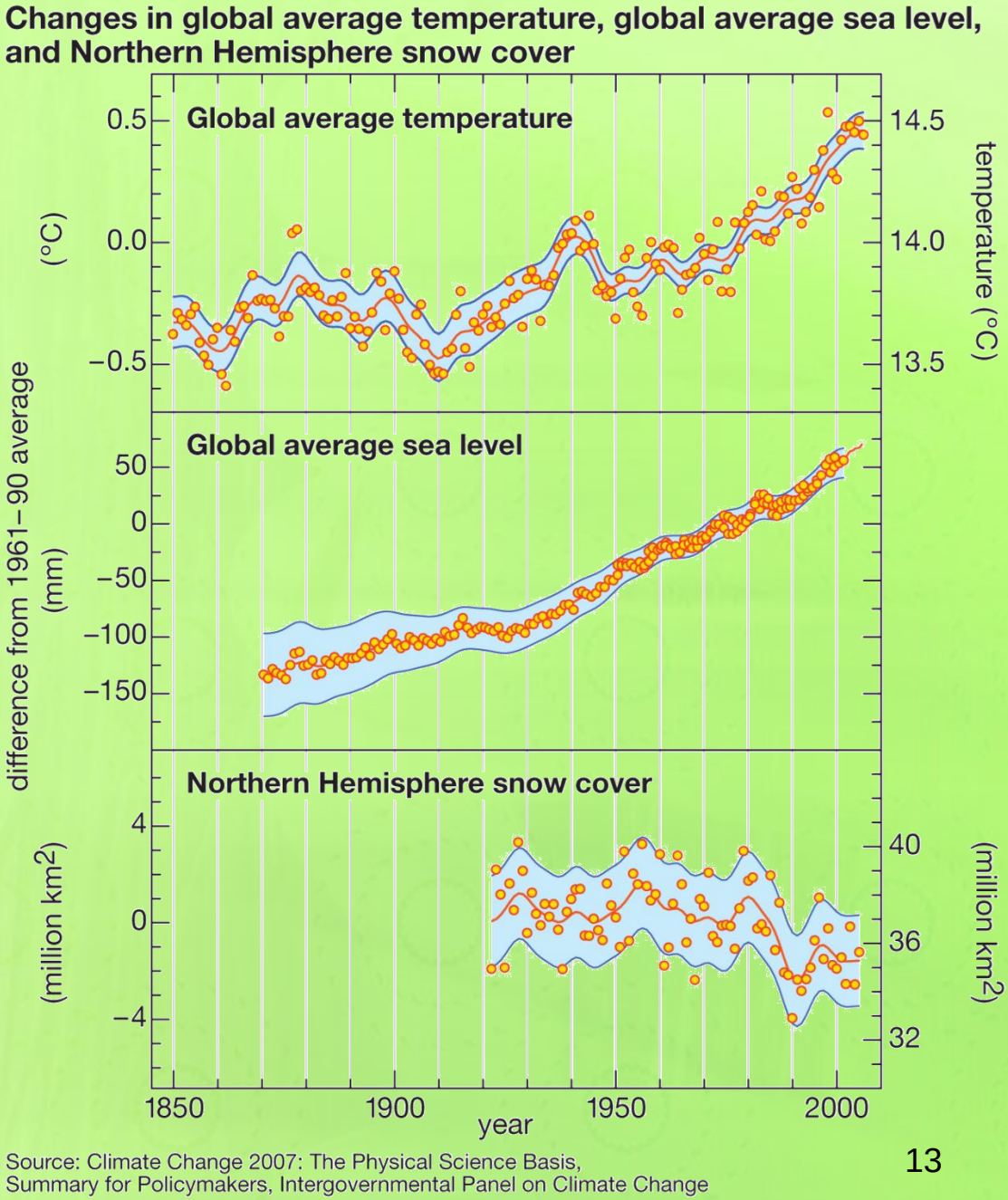


Source: J. Hansen et al., PNAS 103: 14288-293 (26 Sept 2006)

Contributions to global sea level rise (annual averages 1993-2010)

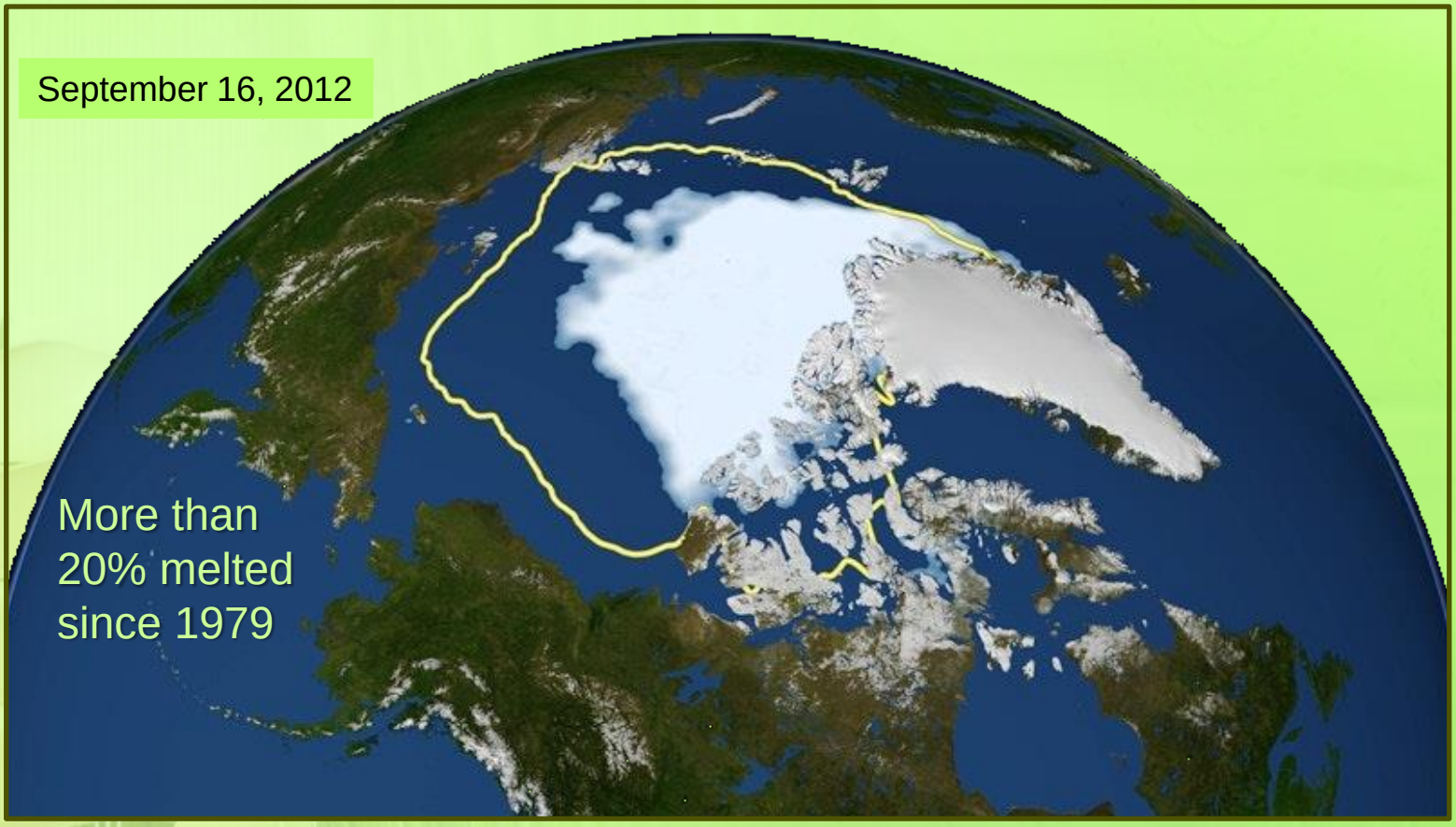
- ✓ **Thermal expansion** of water due to temperature rise = **1.1 mm**
- ✓ **Melting glaciers** = **0.86 mm**
- ✓ **Greenland ice sheet** = **0.33 mm**
- ✓ **Antarctic ice sheet** = **0.27 mm**

(Source: China Dialogue Ocean)



Source: Climate Change 2007: The Physical Science Basis, Summary for Policymakers, Intergovernmental Panel on Climate Change

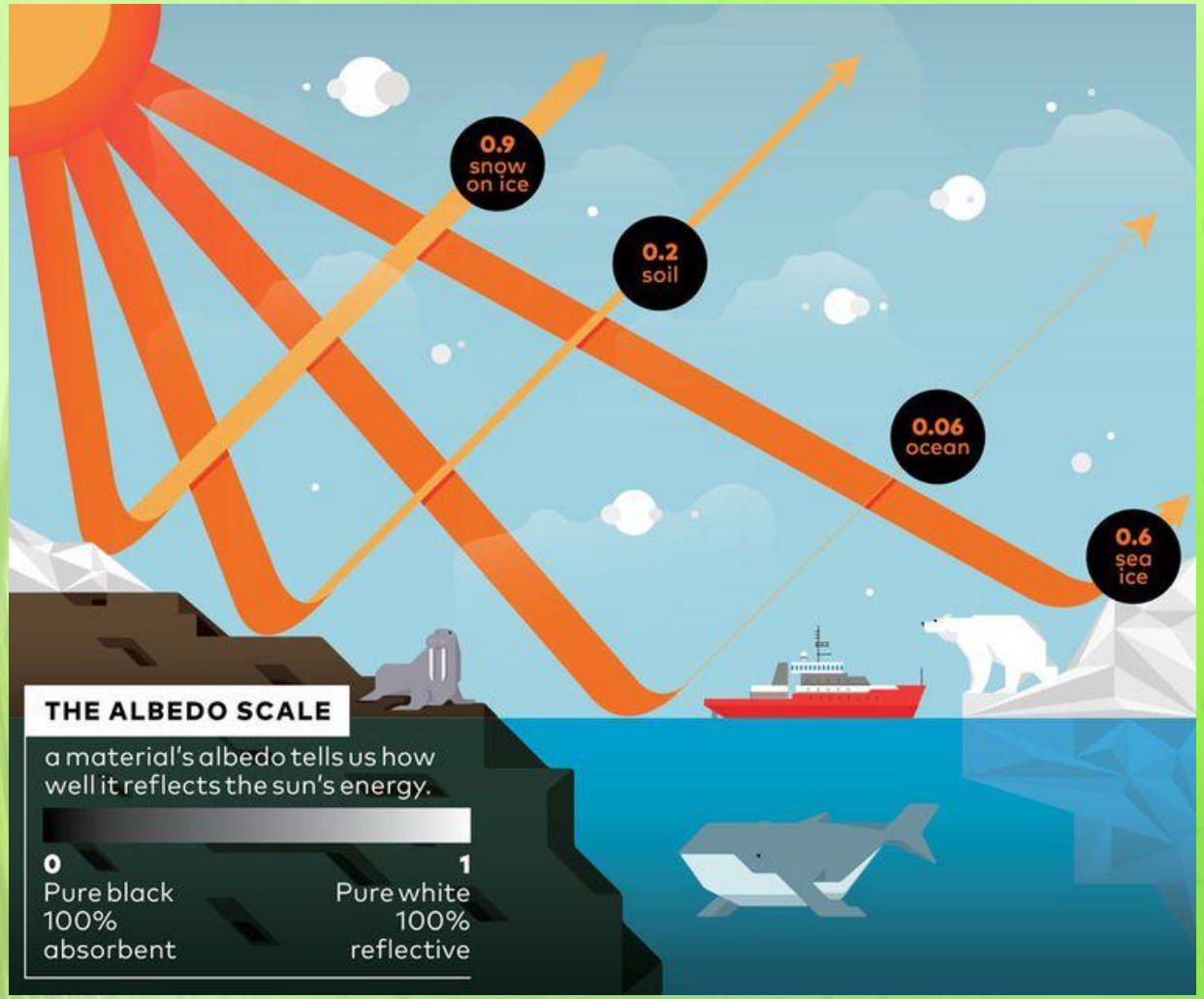
How much snow coverage lost in northern hemisphere?



Arctic sea ice record minimum extent set in September 2012. The average sea ice minimum extent for the years 1979-2010 is shown by the yellow outline. The Arctic has exhibited severe instability over the last year, leaving experts concerned that this September could see a new record minimum, which could have major impacts on global weather. (Graphic Courtesy of NASA)

The albedo scale: *indication of reflectivity of the sun's energy*

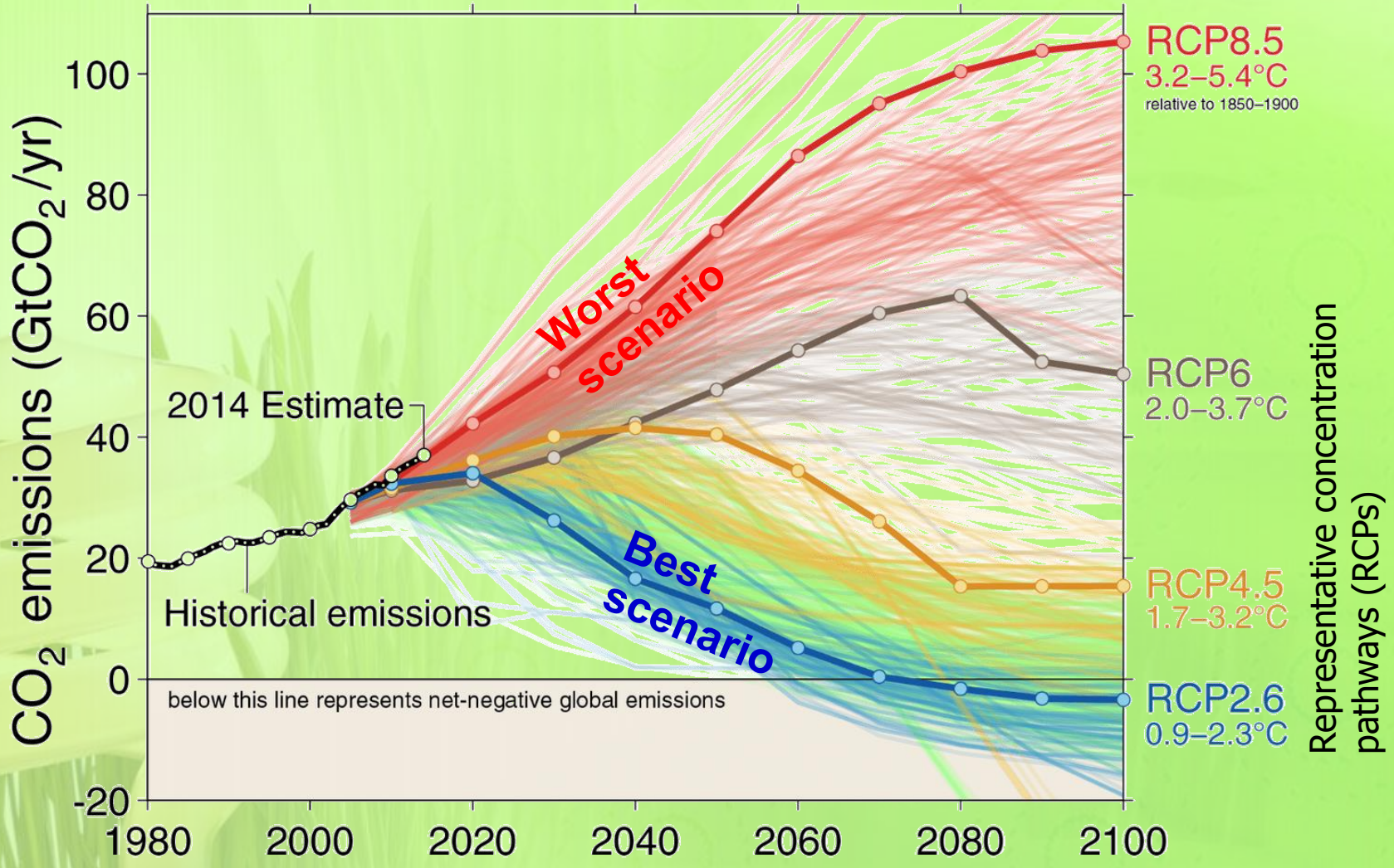
Material	Albedo Scale
Snow on ice	0.9
Soil	0.2
Sea ice	0.6
Ocean	0.06



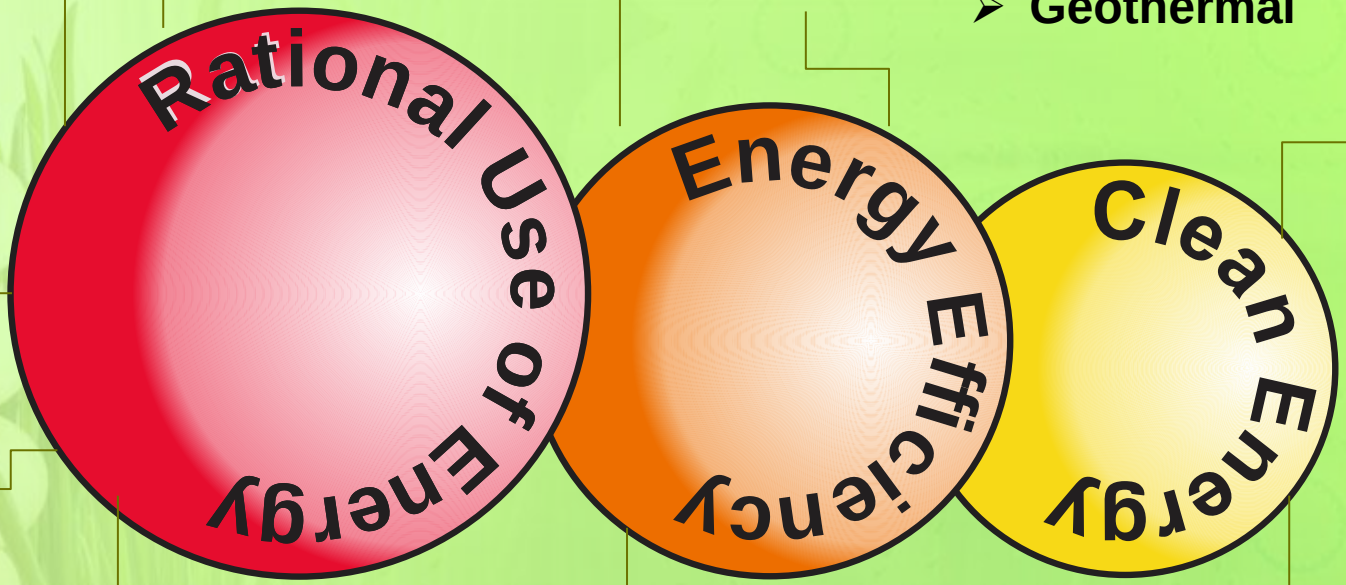
Source: Popular Science, 2017

Future CO_2 Scenarios

(Source: Intergovernmental Panel on Climate Change, 2014)



Engineering activities involved in energy management



Use of sensors

Energy storage

Time of use

Fuel switching

Intelligent control systems

Energy efficient technologies

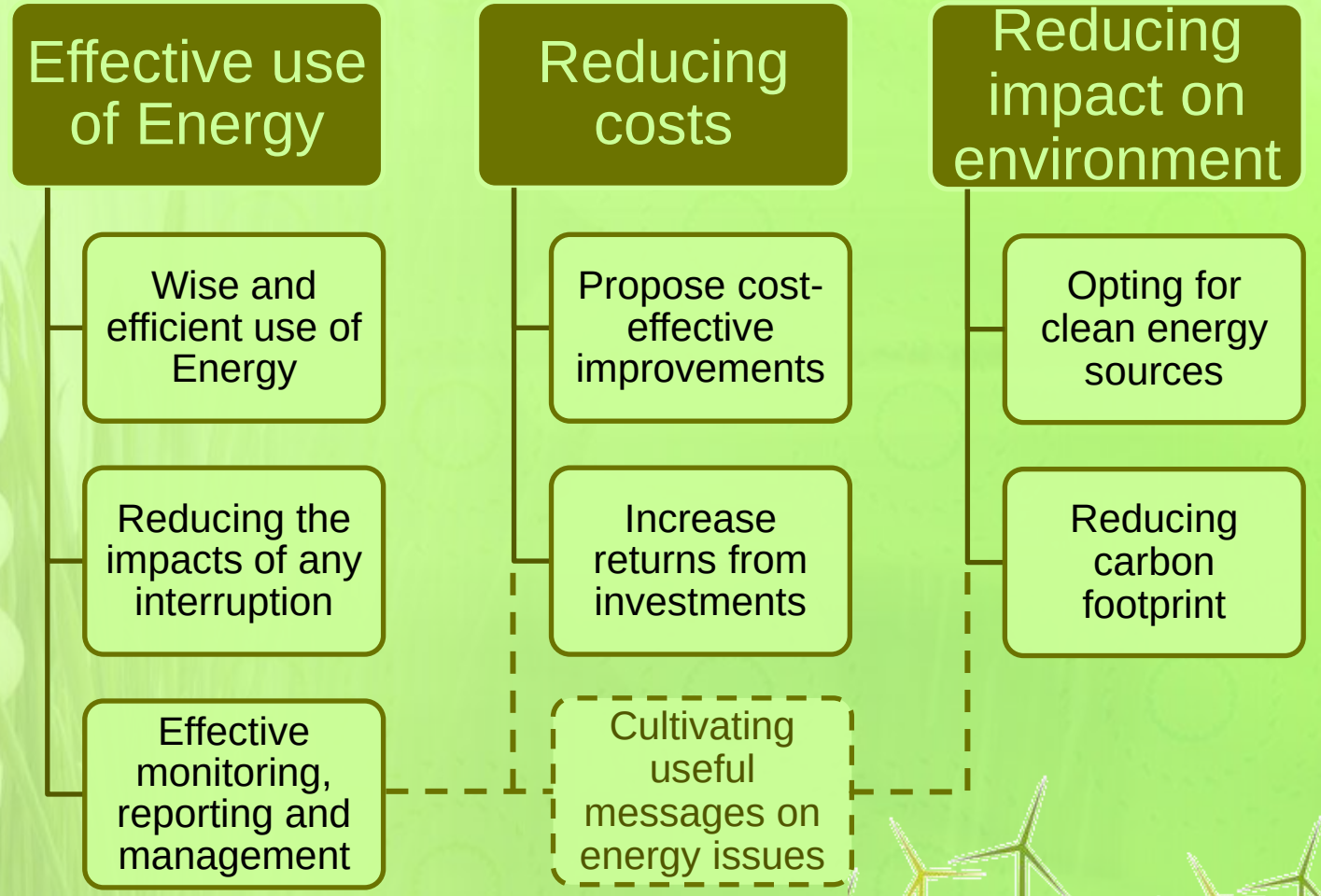
Thermal insulation

Renewables:

- **Solar energy**
- **Wind energy**
- **Wave energy**
- **Geothermal**

Waste energy recovery

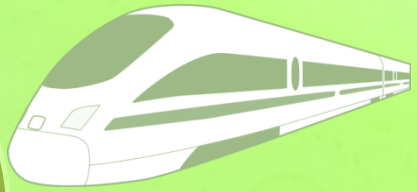
Primary objectives of energy management



Can energy management contribute to sustainability?

City planning, buildings and Industry

Mobility & transport sector



Energy management

Preserving oil reserves

Saving money

Saving the environment