

# National Greenhouse Gas Emission Management System for the Kingdom of Saudi Arabia

## GREENHOUSE 2011

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# National Greenhouse Gas Emission Management System for the Kingdom of Saudi Arabia

## Presentation

- ✓ Background
- ✓ KSA Challenges
- ✓ Greenhouse Gas Emissions
- ✓ Greenhouse Gas Emission Management Initiatives
- ✓ National Greenhouse Gas Emission Management System Architecture
- ✓ Summary



KSA = Kingdom of Saudi Arabia

# National Greenhouse Gas Emission Management System for the Kingdom of Saudi Arabia

## Background

- o The Kingdom of Saudi Arabia (KSA) is one of the leading global energy suppliers and a rapidly developing country in the world
- o Conventional oil reserve is about 260 billion barrels (top position with about 25% of global oil reserve) and natural gas reserve is 275 trillion cubic feet (4<sup>th</sup> position with about 6% of global natural gas reserve)
- o Recent oil and gas productions are about 2,987 million barrels and 3,123 billion cubic feet per year
- o Produces about 698 million barrels of refined products per year
- o Crude oil, refined products and Natural Gas Liquid (NGL) exports are 2,288, 149, and 278 million barrels
- o Only oil and gas are used as domestic fossil fuel
- o A signatory of United Nations Framework Convention on Climate Change (UNFCCC)

Source: Ministry of Petroleum & Minerals, Kingdom of Saudi Arabia (2009)  
Saudi Aramco (2009)



# National Greenhouse Gas Emission Management System for the Kingdom of Saudi Arabia

## KSA Challenges

- o Major Challenges
  - o Ensure stable global energy supply with increasing demand
  - o Comply with its signatory commitments to UNFCCC
    - ✓ Develop, periodically update, publish and make available to the Conference of the Parties (COP) its National Inventories of Greenhouse Gas (GHG) emissions and sinks
    - ✓ Use comparable methodologies for GHG emission and removal inventories
    - ✓ Develop and refine an internationally-agreed methodology and software for calculation and reporting of national emissions
    - ✓ Establish a data management system for collection, management, review, and reporting of national data
  - o Maintain rapid national development and industrialization in a sustainable manner
  - o Meet increasing national energy demand



# National Greenhouse Gas Emission Management System for the Kingdom of Saudi Arabia

## KSA and Greenhouse Gas Emissions

- o A team from King Fahd University of Petroleum & Minerals (KFUPM), Presidency of Meteorology and Environment (PME) and Saudi Aramco is engaged in development of National Greenhouse Gas Emissions Inventories for KSA
- o Saudi Aramco, the largest global oil company is the sponsor for National Greenhouse Gas Emission Inventory projects at KFUPM 
- o 1990 National GHG Inventory Report was submitted to UNFCCC in 2005. 
- o 1990 Global Rank was 32 and 37 based on total and per capita greenhouse gas emissions
- o KSA is currently developing the 2000 National GHG Inventory Report
- o Initiated the process of developing appropriate policies and tools pertinent to Greenhouse Gas Emissions

# National Greenhouse Gas Emission Management System for the Kingdom of Saudi Arabia

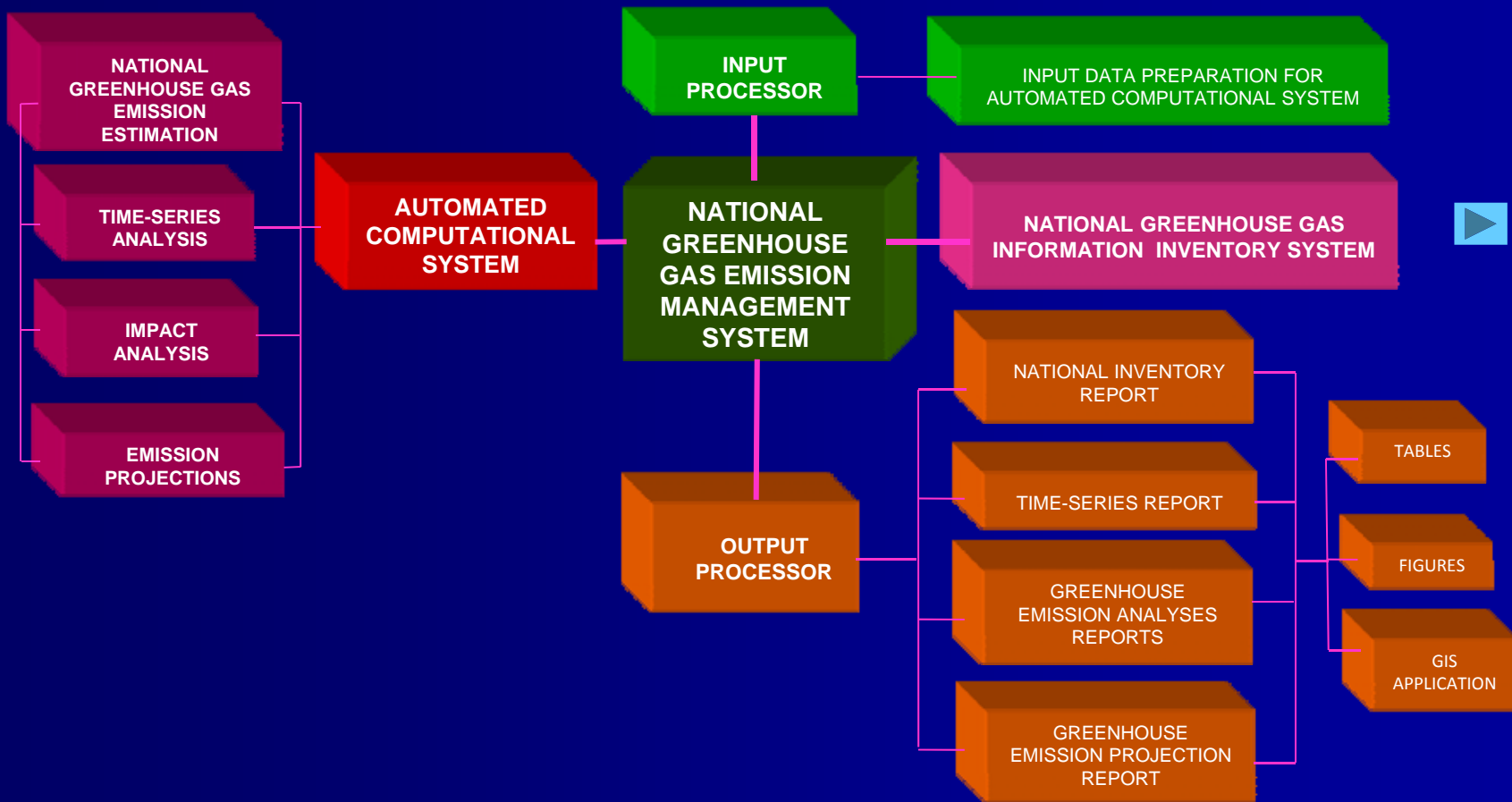
## KSA Initiatives for Greenhouse Gas Emissions Management

- o In line with its commitments to UNFCCC, the Global community, and the nation, KSA initiated a wide range of R&D and policy development programs including search for alternative/renewable energy and development of appropriate technology for GHG emission control in a number of leading national organizations
  - ✓ King Abdulaziz City for Science & Technology (KACST)
  - ✓ National Universities and Research Organizations
- o Development of National Greenhouse Gas Emission Management System for KSA – a recent initiative at the Center for Environment & Water, King Fahd University of Petroleum & Minerals
  - ✓ A GIS-compatible User-friendly Database Management System (DBMS) for inventory of greenhouse gas emission sources and sinks
  - ✓ Computational Tools for a wide range of greenhouse gas emissions related studies
  - ✓ Windows-based Graphical User Interface (GUI) that integrates the DBMS, and the Computational tools including user-friendly Input and Output processors for a wide range of stakeholders



# National Greenhouse Gas Emission Management System for the Kingdom of Saudi Arabia

## System Architecture



# National Greenhouse Gas Emission Management System for the Kingdom of Saudi Arabia

## User Interface

National Greenhouse Gas Inventory for Saudi Arabia

NATIONAL GREENHOUSE GAS EMISSION MANAGEMENT SYSTEM

Information Inventory System Automated Computational System Exit About You are logged in as GH

Source Specific Estimation  
Add New Project  
Manage Existing Project

Time Series Analysis  
Add New Project  
Manage Existing Project

Impact Analysis  
Add New Project  
Manage Existing Project

Emission Projections  
Add New Project  
Manage Existing Project

National GH Gas Emission I...  
Add New Project  
Manage Existing Project

Welcome to  
National Greenhouse Gas Emission Management System

Developed By  
Environmental Modeling & Atmospheric Monitoring Group  
Center for Environment & Water  
King Fahd University of Petroleum & Minerals  
Dhahran, Kingdom of Saudi Arabia



# National Greenhouse Gas Emission Management System for the Kingdom of Saudi Arabia

## DBMS Output

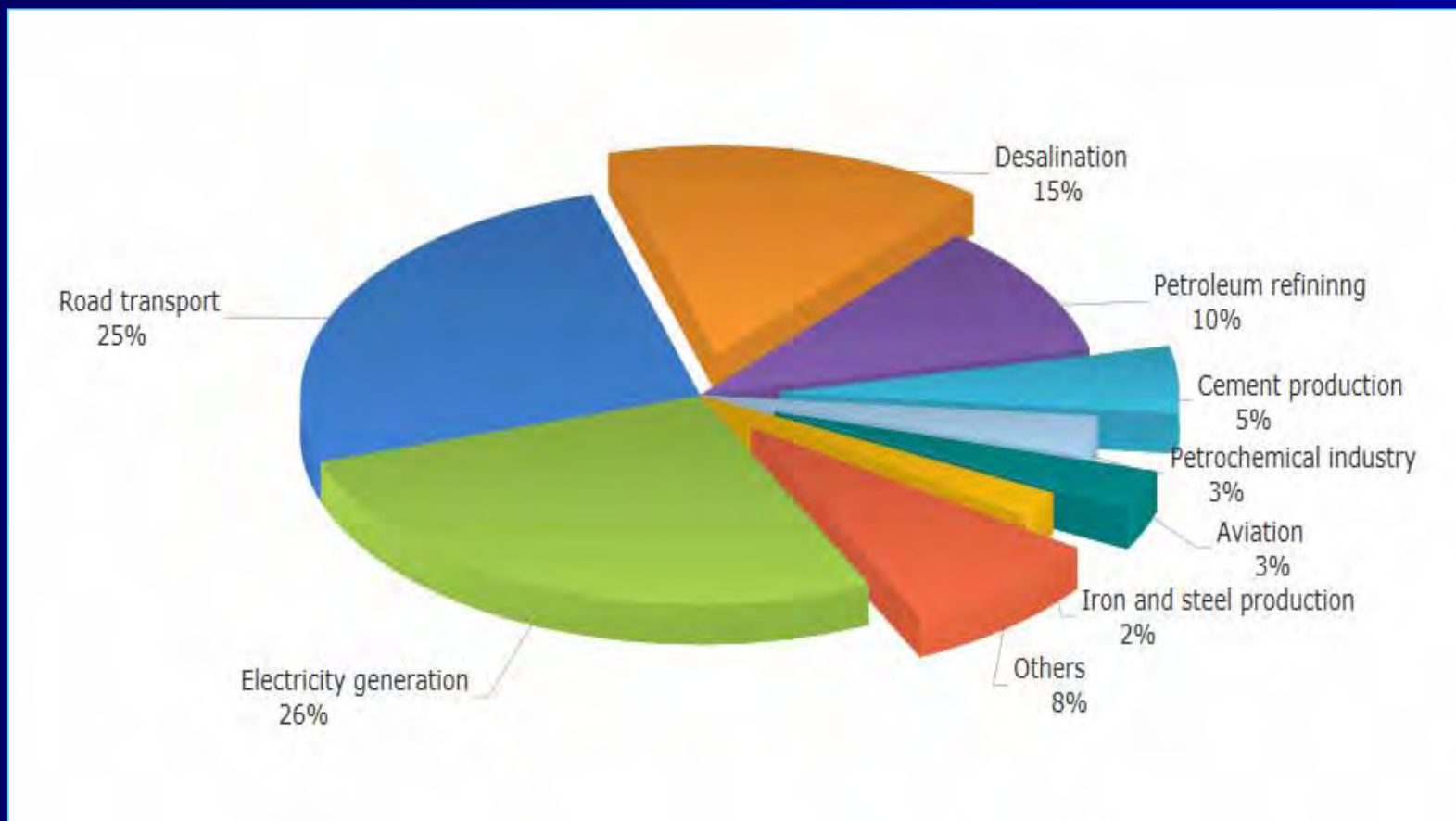
The screenshot displays the National Greenhouse Gas Emission Management System interface. The main window is titled "List of Emission Sources" and shows a table of 11 sources. The interface includes a navigation pane on the left with sections for "Emission Source Inventory", "Greenhouse Gas Emission F...", and "Manage". The "Manage" section lists various categories such as General Source Type, Fuels, Production Parameters, Livestock, Crop, Fertilizer, Cities, Greenhouse Gases, Units, and Users. The table of emission sources is as follows:

Serial No.	Source Name
1.	Abqaiq Gas Processing Plant
2.	Abqaiq Heat Producing Plant
3.	Abqaiq Plant Operation Department (Oil and Gas Transportation)
4.	Abqaiq Plants Operation Department
5.	Abqaiq Producing GOSPs
6.	Abqaiq Utility Division-Abqaiq Community Sewage Treatment Plant
7.	Abqaiq Utility Division-Abqaiq Medinat Sewage Treatment Plant
8.	Abu Ali Land Camp
9.	Agricultural Activities
10.	Al - Jubail Fertilizer Co. (SAMAD) - Jubail
11.	Al-Derbas Road & Maintenance Company

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# National Greenhouse Gas Emission Management System for the Kingdom of Saudi Arabia

## KSA National Greenhouse Gas Emissions 1990



Source: PME(2005)

# National Greenhouse Gas Emission Management System for the Kingdom of Saudi Arabia

## Time-series Analyses

The screenshot displays the 'National Greenhouse Gas Emission Management System' interface. The main window is titled 'New Project - Time Series'. The project name is 'Test Project' and the title is 'Power Plant A (2005 to 2010)'. The source category is 'Individual Source' and the year of estimation is from 2005 to 2010. The individual source is 'Power Plant A'. The emission factors are set to 'IPCC (default)'. The contributing sector is 'ENERGY'. The greenhouse gases selected are CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O. The activity data is set to 'Use Available Data'. The fuel combustion activities table shows two entries for 'Power Plant A' in 2005, with fuel 'Natural gas' and quantities of 420052 tons and 521234 tons. The status is 'Emission estimation successful'. On the right, the 'Estimated Emissions' section shows a bar chart for CO<sub>2</sub> emissions (tons) from 2005 to 2010, with a total of 10,635 tons. The chart shows a steady increase in emissions over the period.

Source Name	Year	Fuel	Quantity	Unit
Power Plant A	2005	Natural gas	420052	tons
Power Plant A	2005	Natural gas	521234	tons

CO<sub>2</sub> Emission (tons): 10,635

Year	Emission (tons)
2005	1000
2006	1500
2007	1800
2008	2000
2009	2500
2010	3800

# National Greenhouse Gas Emission Management System for the Kingdom of Saudi Arabia

## Impact Analysis



Source: PME(2005)

# National Greenhouse Gas Emission Management System for the Kingdom of Saudi Arabia

## Greenhouse Gas Emissions Projection

The screenshot displays the 'National Greenhouse Gas Emission Management System' interface. The main window is titled 'New Project - Emission Projections' and contains the following elements:

- Project Information:** Name: New Project, Title: Power Plant A (2020). Individual Source: Individual Source (selected), General Source Group: pow.
- Emission Projection:** Method: Linear, Year: 2020, Contributing to: ENERGY.
- Emission Factors:** IPCC (Default) selected. Greenhouse Gases: CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O (all checked).
- Activity Data Table:**

Year	CO <sub>2</sub> Emission(Gg)	CH <sub>4</sub> Emission (tons)	N <sub>2</sub> O Emi
2005	1156	20.7085	2.0708
2006	1434	25.6966	2.5697
2007	1608	28.8007	2.8807
2008	1718	30.779	3.0779
2009	1965	35.5566	3.5557
2010	2734	48.9756	4.8976

- Estimated Emissions:** Select the Gas: CO<sub>2</sub>. A bar chart shows actual emissions (blue) and projected emissions (orange) from 2005 to 2010.
- Projected Data Table:**

Year	CO <sub>2</sub> Emission(Gg)	CH <sub>4</sub> Emission (tons)
2011	3029	54.2679
2012	3325	59.5602
2013	3620	64.8525
2014	3916	70.1449

Status: Emission estimation successful

# National Greenhouse Gas Emission Management System for the Kingdom of Saudi Arabia

## GIS Application

The screenshot displays the National Greenhouse Gas Emission Management System (NGGEMS) GIS application. The window title is "National Greenhouse Gas Inventory for Saudi Arabia". The main header reads "NATIONAL GREENHOUSE GAS EMISSION MANAGEMENT SYSTEM". Below the header, there are navigation tabs: "Information Inventory System", "Automated Computational System", and "Exit". The user is logged in as "GH".

The interface is divided into several sections:

- Emission Source Inventory:** Includes options for "Data Entry and Analysis", "Add New Emission Source", "Manage Existing Emission Sources", and "Reports".
- Greenhouse Gas Emission Factors:** Lists "IPCC Tier-1", "Country Specific", "User Defined", and "KUPM 2000" with a "<<Manage>>" link.
- Manage:** A tree view for managing various parameters such as "General Source Type", "Groups", "Fuels", "Production Parameters", "Livestock", "Crop", "Fertilizer", "Cities", "Greenhouse Gases", "Units", and "Users".
- Information Bank:** A section for accessing data.

The central map area shows a satellite view of a desert landscape. Overlaid on the map are two charts:

- GHG Emissions Source, tCO<sub>2</sub>e:** A pie chart showing the distribution of emissions across different sources.
- GHG Emission, 2000 - 2010:** A bar chart showing the annual greenhouse gas emissions from 2000 to 2010, showing a general upward trend.

The map includes navigation controls (2D, 3D, Road, Aerial, Labels) and a scale bar at the bottom right indicating 10 miles.

# National Greenhouse Gas Emission Management System for the Kingdom of Saudi Arabia

## Summary

- o Ensuring stable energy supply for increasing global demand while complying with its signatory commitments to UNCCC and national energy demand for rapid development and industrialization is a real challenge for the Kingdom of Saudi Arabia
- o A wide range of R&D and policy initiatives are being launched at different levels
- o Developed National Greenhouse Gas Emission Management System is expected to provide necessary tools for planning, design and implementation of a broad spectrum of national initiatives for management of greenhouse gas emissions from various sources

# National Greenhouse Gas Emission Management System for the Kingdom of Saudi Arabia

GREENHOUSE 2011

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*Thank you*

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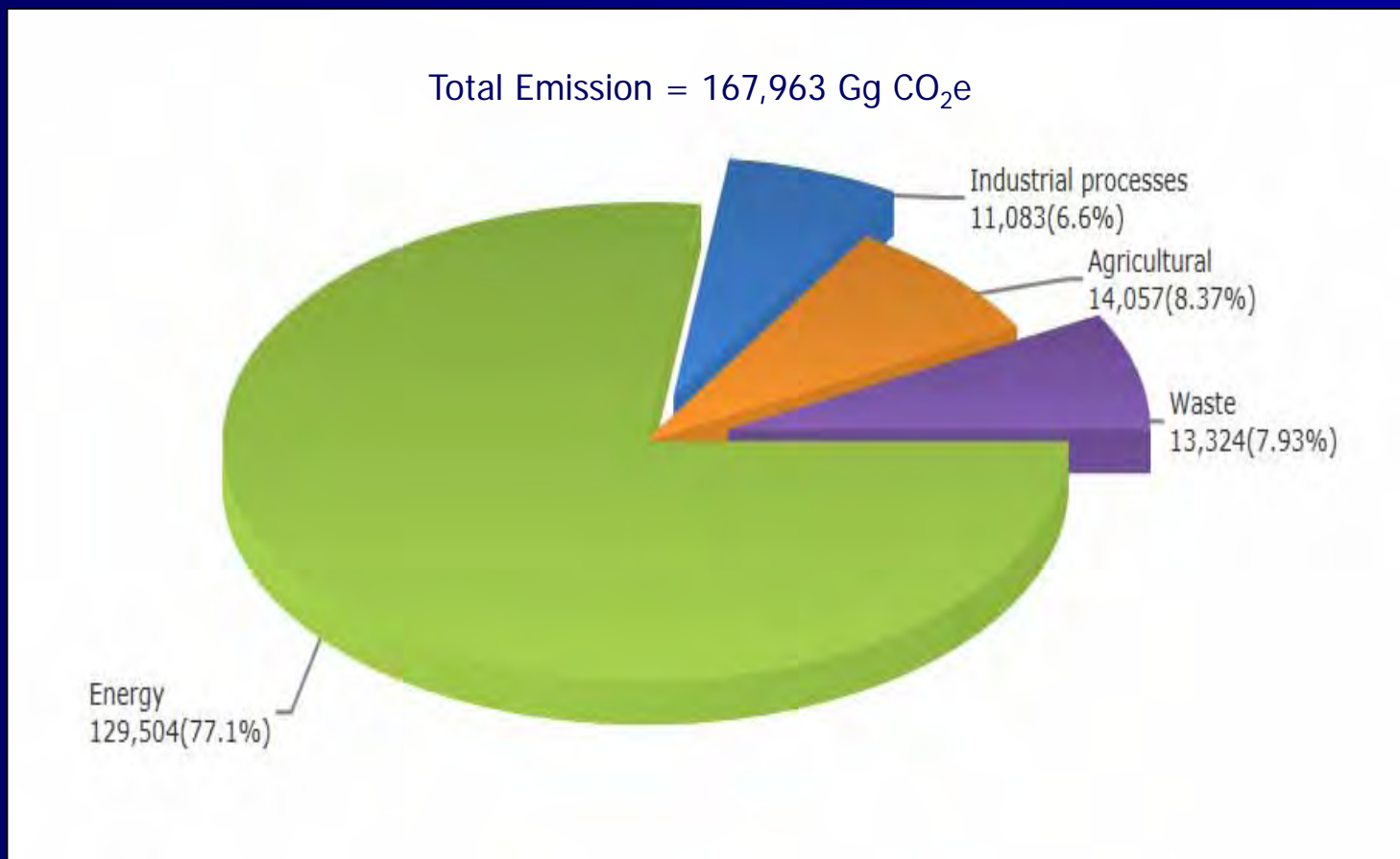
[www.kfupm.edu.sa](http://www.kfupm.edu.sa)





# National Greenhouse Gas Emission Management System for the Kingdom of Saudi Arabia

## KSA National Greenhouse Gas Emissions 1990



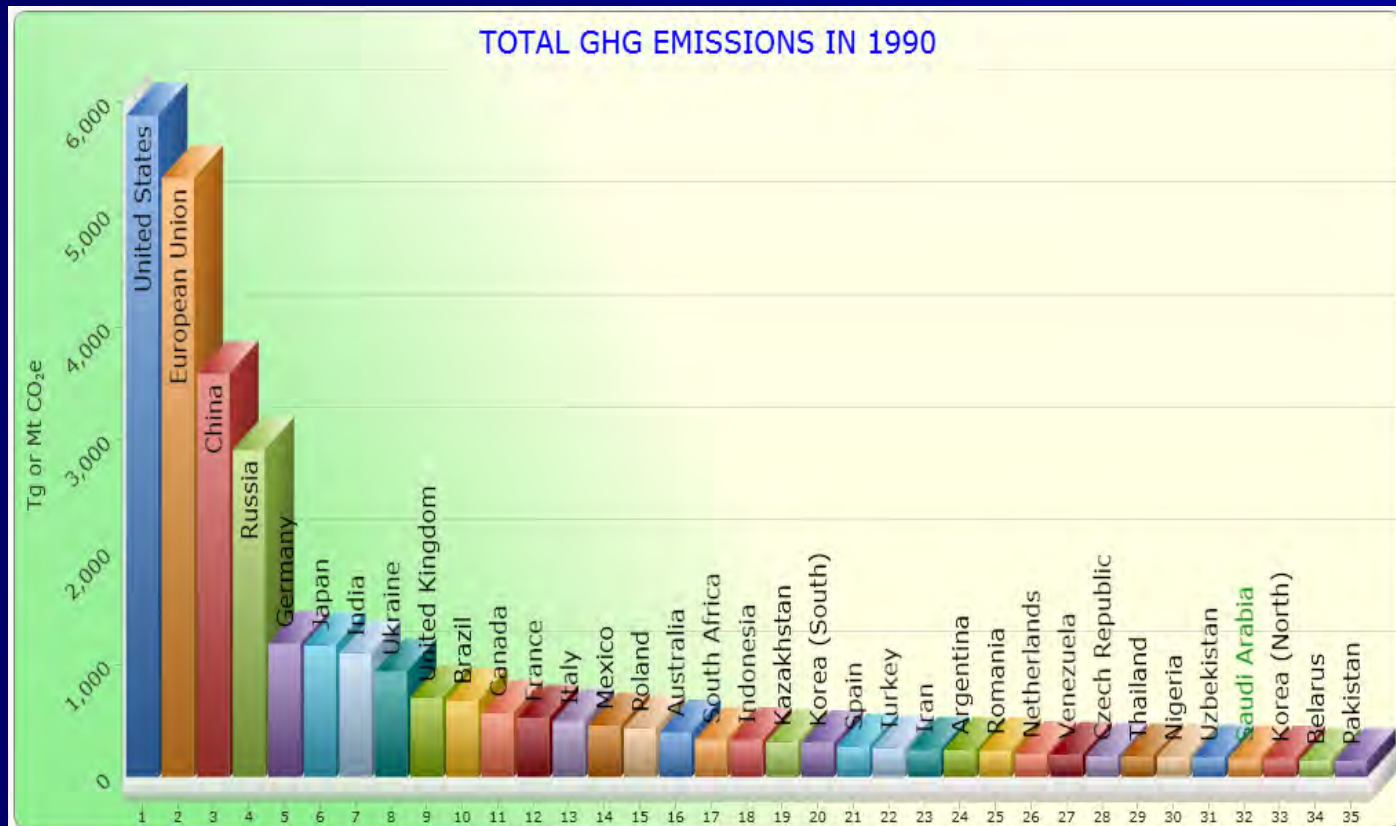
Source: PME(2005)



# National Greenhouse Gas Emission Management System for the Kingdom of Saudi Arabia

## KSA and Greenhouse Gas Emissions

Kingdom of Saudi Arabia and Other Countries 1990

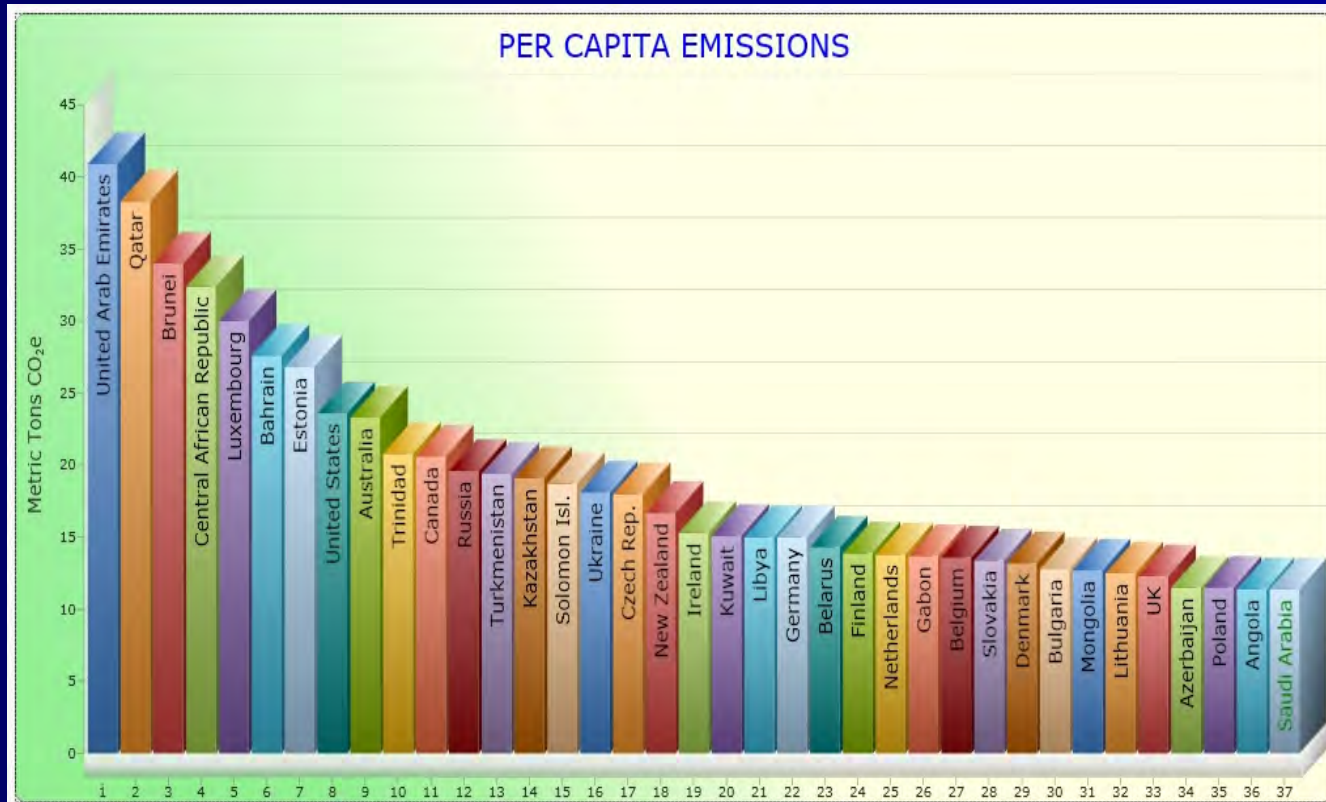


Source: KSA Emission from PME(2005) Other Countries from CAIT (2010)

# National Greenhouse Gas Emission Management System for the Kingdom of Saudi Arabia

## KSA and Greenhouse Gas Emissions

Kingdom of Saudi Arabia and Other Countries 1990



Source: KSA Emission from PME(2005) Other Countries from CAIT (2010)

# National Greenhouse Gas Emission Management System for the Kingdom of Saudi Arabia

## Database Management System Architecture

