

Green & Low Carbon Approach



– in Oil & Gas

EOL's 6 year's journey since inception

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EOL's Green & Low Carbon Approach.....

Basics.....



Essar Oil Limited since the time of planning to set up of its Refinery at Jamnagar, Gujarat, had major focus towards Energy Efficient and Low Carbon Technology selection. It further adopted a Green & Low Carbon approach since the beginning of commercial production in 2008. Till date it has:

- Almost doubled its capacity from 10.5 MMTPA to 20 MMTPA to become the 2nd largest single location Refinery in India.
- Enhanced its capability to process some of the toughest crudes and yet produce high quality Euro IV and V grade emission compliant products. This was possible through infusion of complex technology and thus enhanced energy consumption. This in turn raised the complexity of Refinery from 6.1 to 11.8, in Nelson Complexity Index and which is amongst the highest globally.
- EOL has simultaneously expanded its upstream Exploration & Production of Coal Bed Methane operations with a current production of 190,000 standard cubic meters per day and expanding.
- Refinery switched to coal based power plant due to regulatory / Business environ to meet its energy requirement and thus enhanced pressure on emissions.

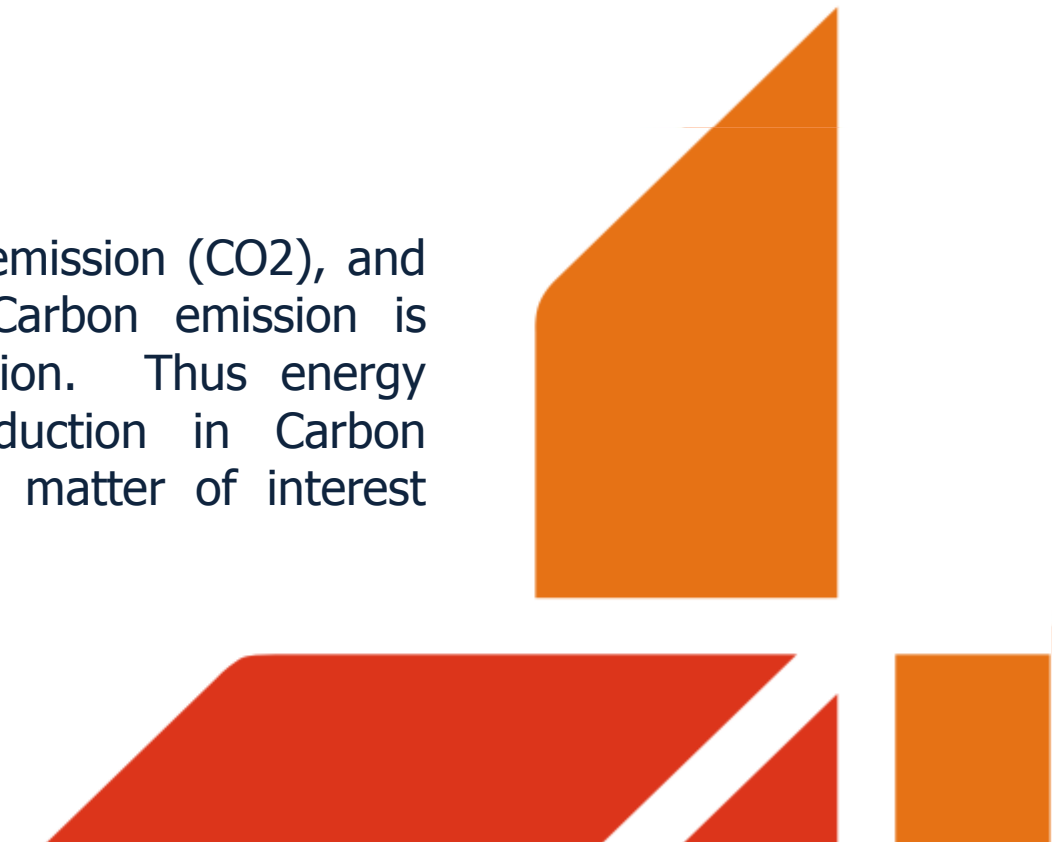
In this back drop:

- **In 2013, Global 3rd party assessment yet again rated EOL best in Carbon Management in India, with least carbon intensity in the Energy Sector, for the THIRD year in a row.**
 - **In 2013, EOL also got another unique distinction to be the only Energy Sector Company to appear in the CARBON LEADERSHIP INDEX securing an all India 2nd rank cutting across all sectors of Businesses & Industries.**
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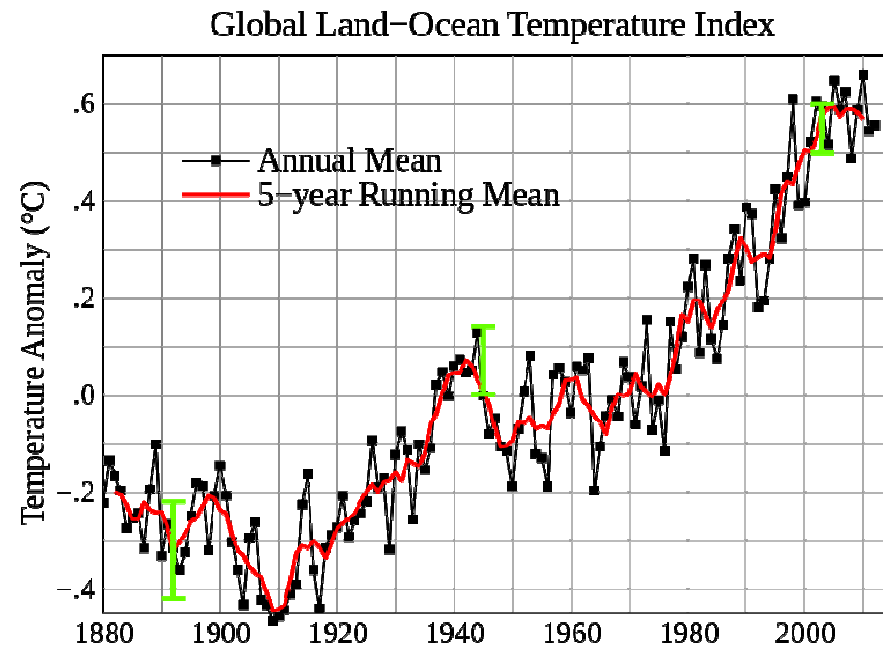
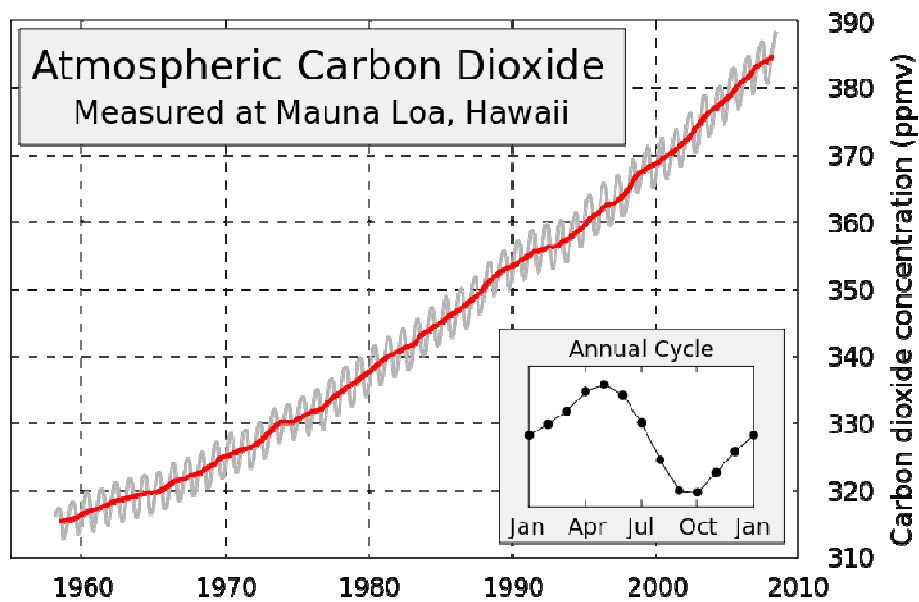
Low Carbon Approach.....

In Oil & Gas.....Relevance ??

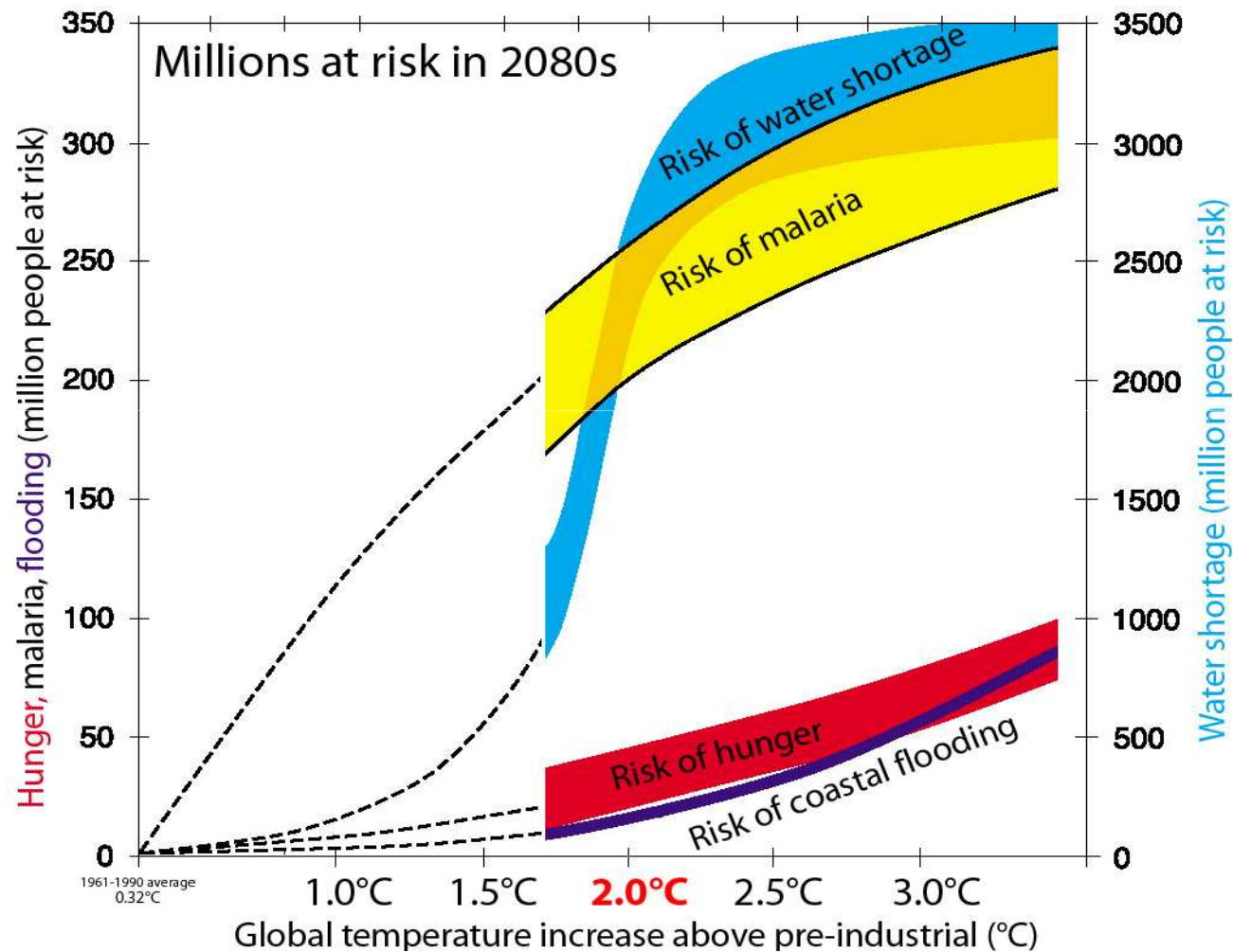
Climate Change is linked to Carbon emission (CO₂), and primarily on the generation side Carbon emission is directly linked to energy consumption. Thus energy efficiency leads to differential reduction in Carbon emission (CO₂) and is the primary matter of interest to..... **Industry.**



Atmospheric Carbon Dioxide and Global Warming Proven Observations.....



Risks Associated With from Global Warming



INFERENCE FOR INDIAN INDUSTRIES

Risk and Opportunities.....



▪ **Regulatory**

- Commitment to 25% voluntary emission Intensity cut from 2005 level by 2020.
- Emission Intensity reduction by 23-24% (determined) / 33-34% (Aggressive) over 2005 level possible @ GDP growth rate of 8-9% - "Low Carbon Strategy for inclusive growth".
- PAT on Energy Efficiency and 5 year plan on Low carbon growth.
- Carbon tax may be by EU/US on Imports from India

▪ **Physical**

- Increased storms, severe Cyclones impacting operations / Financial losses
- Increased Risk management costs. & Pronounced disaster management preparedness

▪ **Stakeholder**

- Increased Customer activism demanding lower GHG intensive products .
- Activism from communities and NGOs requiring Industries to aid towards Sustainable development and growth.
- Work towards engaging stakeholders demands and to address these in a suitable manner

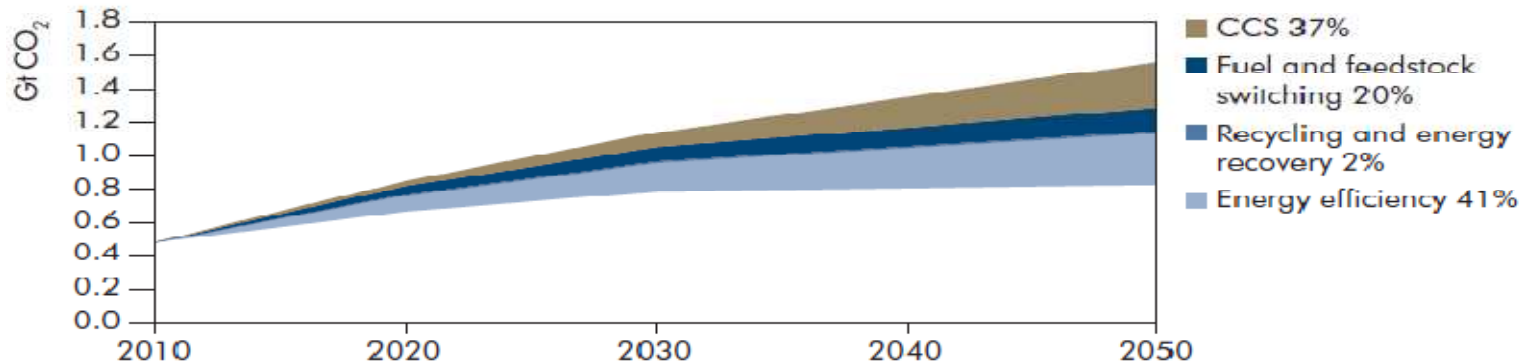
▪ **Financial**

- Increasing impact of cost of Carbon in business
 - Financial liability from all the above aspects
 - Opportunity to Monetize Carbon reduction efforts towards revenue growth.
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Options for CO₂ reduction & Technologies

- for INDIA

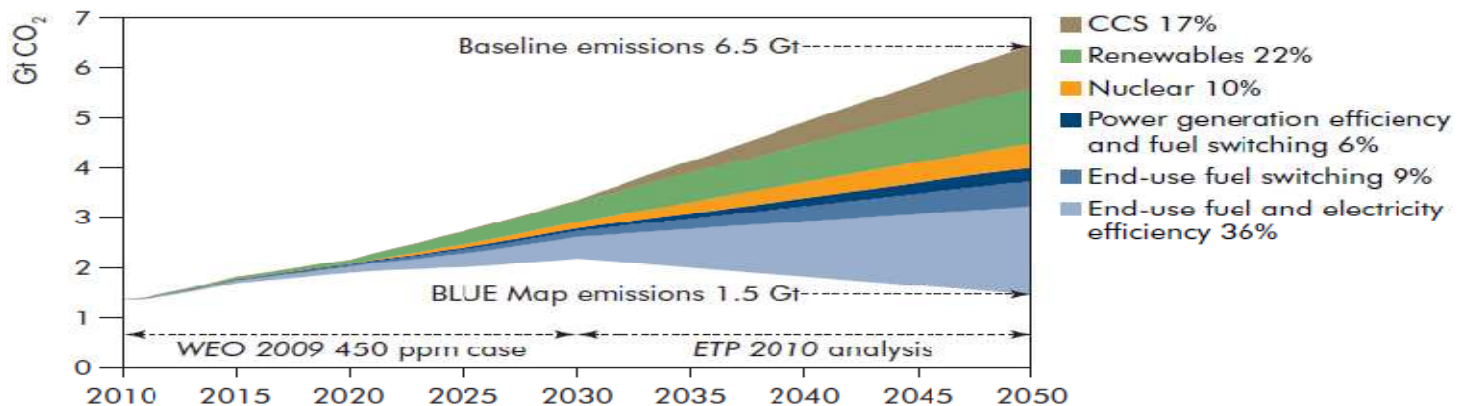
Figure 11.12 ▶ Options for reducing direct CO₂ emissions from Indian industry



Key point

Energy efficiency and CCS represent the main opportunities for India to limit the growth in CO₂ emissions from the industrial sector.

Figure 11.5 ▶ Contributions to emissions reduction in India



Sources: IEA (2009a and 2009b); IEA analysis.

Key point

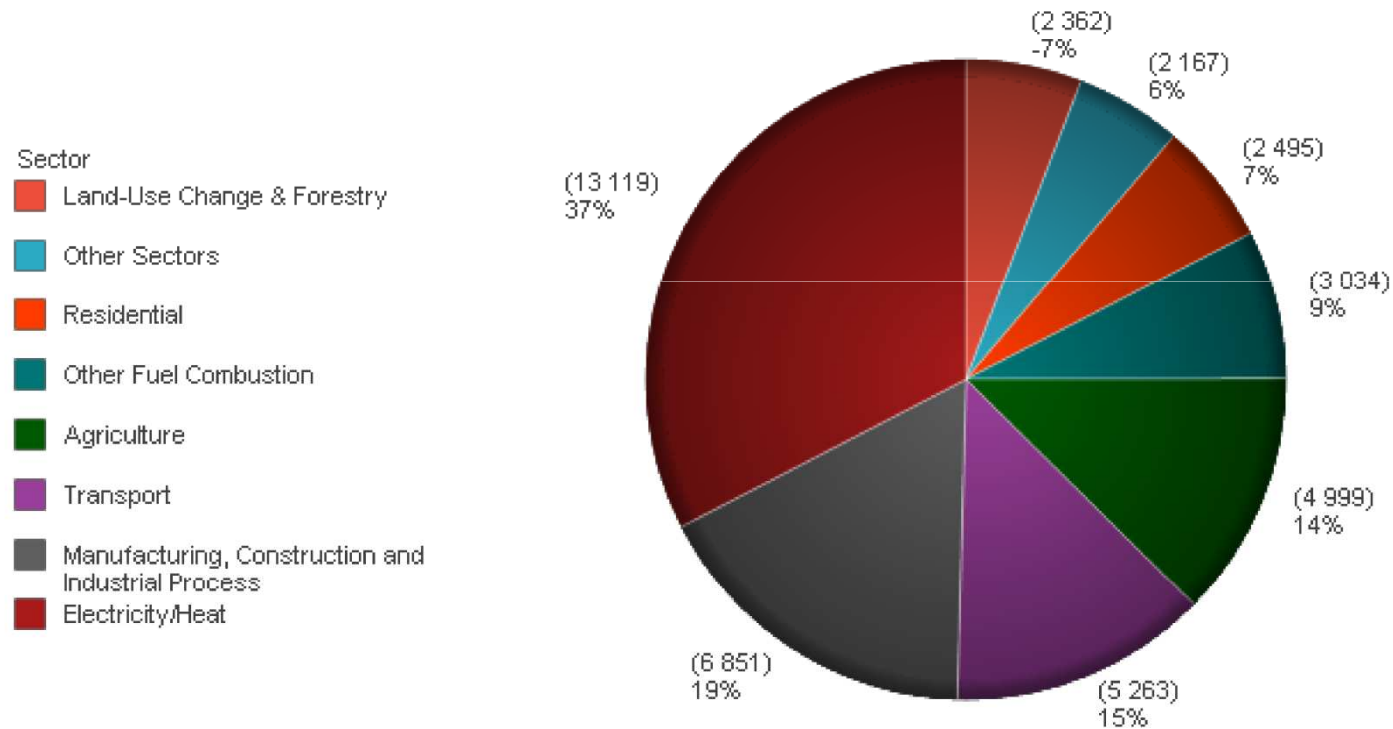
In the BLUE Map scenario, CO₂ emissions will be 77% lower in 2050 than in the Baseline scenario.

Oil & Gas sector.....??

.....Sectoral Apportionment of GHG



World GHG Emissions
from Several Sectors in 2010 (MtCO₂eq)



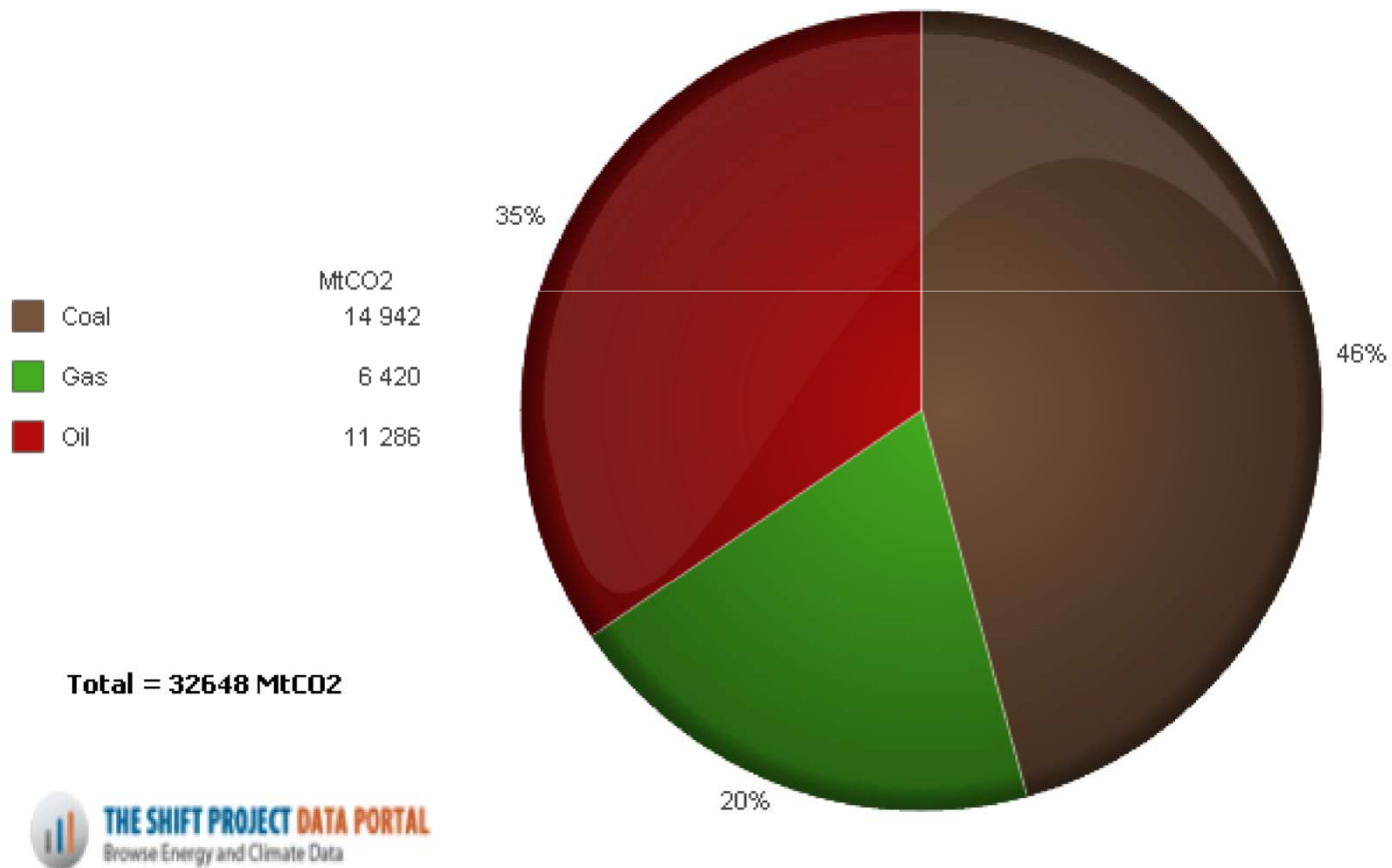
Total = 35566,2 MtCO₂eq



Oil & Gas sector.....??CO2 from consumption of Energy



World CO2 Emissions from the consumption of Energy
in 2011 (MtCO2)

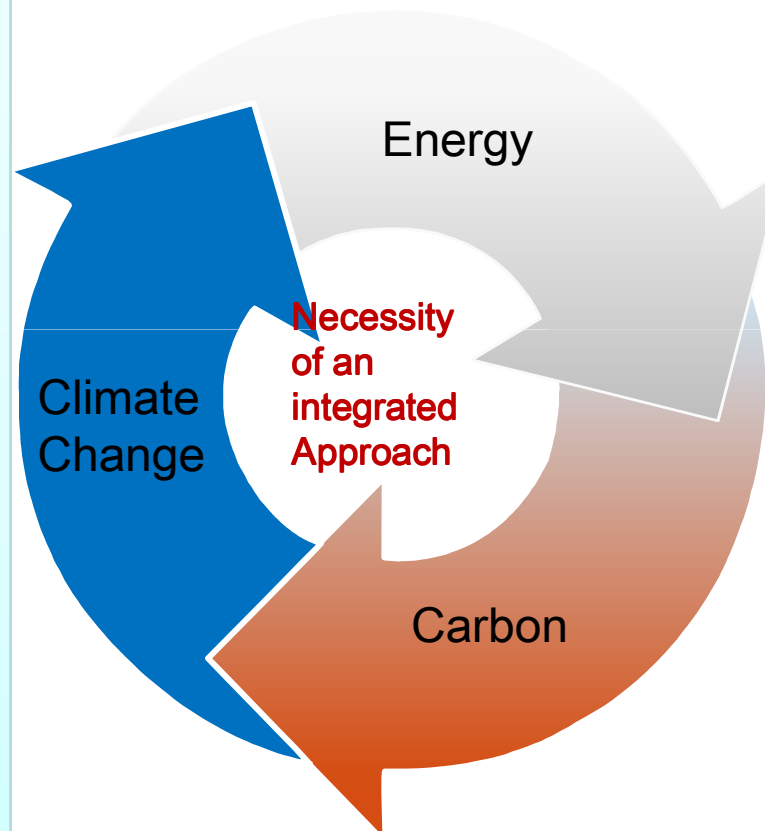


WHY Carbon Mitigation in Oil & Gas --- Connectivity



Climate Change

Climate Change is linked to Carbon emission, and primarily on the generation side Carbon emission is directly linked to energy consumption. Thus energy efficiency leads to differential reduction in Carbon emission and is the primary matter of interest to.....
Industry.



Energy

- One of the prime comp of OPEX in the Oil & Gas process businesses.
- Energy use
 - Direct impact on the bottom-line.
 - Constrained by rising fuel prices & availability
 - upcoming regulations like PAT

Carbon

- Major source of energy
- Key component of the raw material.
- Principal source of GHG emissions.
- Constrained by environmental regulations, stakeholder concerns & process requirements.

GHG Emitters in a Refinery

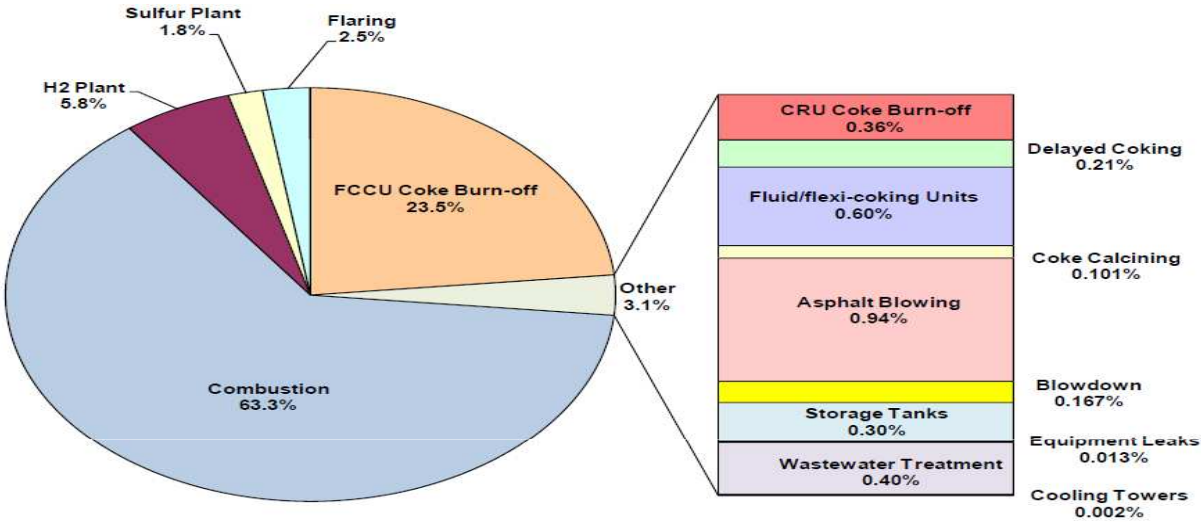


Figure 2. Contribution of different emission sources to the nationwide CO₂ equivalent GHG emissions from petroleum refineries.

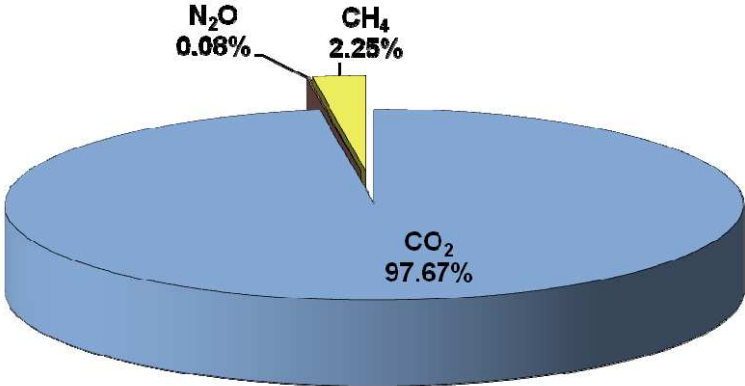
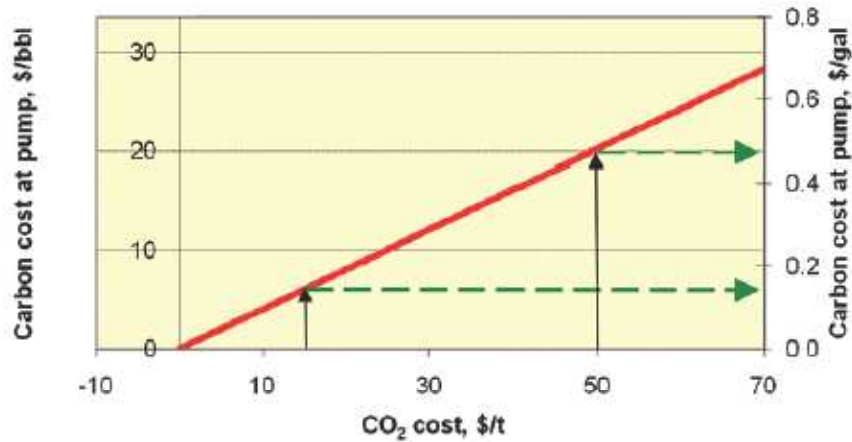


Figure 3. GHG emissions from petroleum refineries.

Cost of Carbon



Courtesy – Study by KBC

Carbon burden on refinery gasoline is approx US \$ 5/bbl for CO₂ price @ US \$ 15/t

At US \$ 50/t of CO₂ the cost would rise to US \$ 20/bbl

Refineries would therefore be required to recover this cost from consumers

REFINERY CO₂ EMISSIONS

Refinery Configuration	T CO ₂ / t Crude
EU 27 Average	0.22
Hydroskimming (Basic configuration)	0.08 – 0.15
FCC + VB	~0.2
HCU + Coker	0.2 – 0.35
RDS + RFCC (Advanced Configuration)	0.3 – 0.4

Approaches to decrease.....

Energy consumption ????



35% - 40 %

- Energy Pinch based process optimization / modification and design study

15% - 19%

- Advanced Process Control

10% - 14%

- Change process technology, Energy consumption tracking system

5% - 10%

- Real time optimization, Reduce – unreliability, unplanned shutdown/startup etc.

0% - 5%

- Maintenance review, Utility modeling/advisory system, reduce equipment fouling

HOW..... ?????



Options on Low Carbon approach.....

ENERGY EFFICIENCY

Enables less energy use in operations. Applicable both **Upstream** and **downstream**. Typically in downstream refining, energy-related CO₂ emissions - represent 70% of total GHG emissions, and is often higher in upstream.

TECHNOLOGY

Energy Efficient – Low Carbon Technologies various Technology options applicable for both upstream and downstream processing

RENEWABLE FEEDSTOCKS

Renewable refinery feedstocks - displacing part of the refinery's crude oil with renewable-based oils and waste oils and bio fuels.

RENEWABLE TECH

Using solar power to generate steam for enhanced oil recovery, use of NG and RFG as fuel substitute.

CARBON CAPTURE

Capturing and storing carbon emissions, capturing and storing the flue gas emissions from once-through steam generators used in enhanced oil recovery. Carbon Mineralization Technologies



PHOTO: ROLF SCHULTEN

INTEGRATED Low Carbon Approach



INCLUDES: Clean tech assessments, Energy optimisation & implementation, Carbon foot printing & emission management, Carbon Analytics & Carbon Credits, Carbon intensive asset optimisations, and business strategy in light of global & national regulatory environs.

ACTION TAKEN:

ENERGY EFFICIENCY	Primary study on energy consumption tracking, utilization, optimisation and implementation to improve Energy Efficiency at utilities
ENERGY OPTIMIZATION	Real time Process based Energy optimizations to identify process modifications for improvement, increase Energy efficiency and / or throughput, quick win process update / control interventions.
LOW CARBON TECH	Downstream – Ex: FCCU with PRT, Propylene units with Heat Pumps etc. Upstream CBM – Ex: Gas fired Gensets, gas fired compressors
CARBON ACCOUNTING	GHG accounting / footprinting, Emission management, Climate Change approach with INNOVATION AND ADOPTION OF LOW CARBON ENERGY
CARBON CREDITS	Identification & firming up Carbon Credit projects, taking up UN registration process, Closing opportunities to monetize Carbon credits.
CARBON CAPTURE TECHNOLOGIES	Carbon Mineralization Technologies Technological options on Carbon Capture and product stream integration.

Carbon Management



RESULTS SO FAR

CO2 SAVING POTENTIAL Projects undertaken cumulative => 3,50,000 tCO2/annum.

GHG DISCLOSURES 3rd party Global assessment by CDP, UK EOL - CARBON MANAGEMENT ranking

2011 BEST in INDIA in Carbon Management **in the Energy Sector**

Emission Intensity – 0.17 TCO2/Ton Crude – Least in the Oil & gas Sector
(Base year 2009-10 – Emission Intensity - 0.18 TCO2/Ton Crude)

2012 BEST in INDIA in Carbon Management **in the Energy Sector**

Emission Intensity – 0.18 TCO2/Ton Crude – Least in the Oil & gas Sector
(Only Energy Sector Co in the All India "Carbon Leadership List")

2013 BEST in INDIA in Carbon Management **in the Energy Sector**

Emission Intensity – 0.260 TCO2/Ton Crude – Least in the Oil & gas Sector
– 0.022 TCO2 / Ton of Crude / Complexity

(All INDIA 2nd in CARBON LEADERSHIP INDEX cutting across all sectors & Businesses)

THE YEAR ON YEAR GHG ACHIEVEMENTS AGAINST

Doubling of Refining capacity from 10.5 to 20 MMTPA

Increase in complexity from 6.1 to 11.8

Increase in carbon intensity due to switch to coal based power

Increase in carbon intensity due to enhanced CBM production

Global development Drives

=> Enhanced Energy consumption

=> **Climate Change**

=> Drives Carbon Management

A Win–Win Business Proposition



Looking for further Clarifications, Touch Base with:

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