

# Natural resources

Module 2.6

Energy

# Non-renewable energy utilization - Environmental impacts

- During Energy production: extraction to supply
  - Coal mining
  - Oil spills
  - On-site explosions at drilling sites, oil riggs
- During Energy utilization: pollution and climate change
  - Burning gasoline releases hazardous gases and fumes into the air
  - release particles - that can pollute the air, water, and land
  - Upsets Earth's "**carbon budget**," as they release carbon dioxide into the atmosphere.
  - Accelerate "greenhouse effect."
- Burning petroleum release CO<sub>2</sub>, CO, SO<sub>2</sub>, NO<sub>x</sub> and volatile organic compounds (VOC) which contribute to smog (ground level ozone) Particulate matter (PM) which contributes to asthma and chronic bronchitis in humans
- Lead and various air toxins such as **benzene, formaldehyde, acetaldehyde, and 1,3-butadiene** which also emitted when some types of petroleum are burned, all of which come with significant human health hazards
- Fuel exploring and drilling disturbs natural habitats on land and in the sea



The Coal  
concern

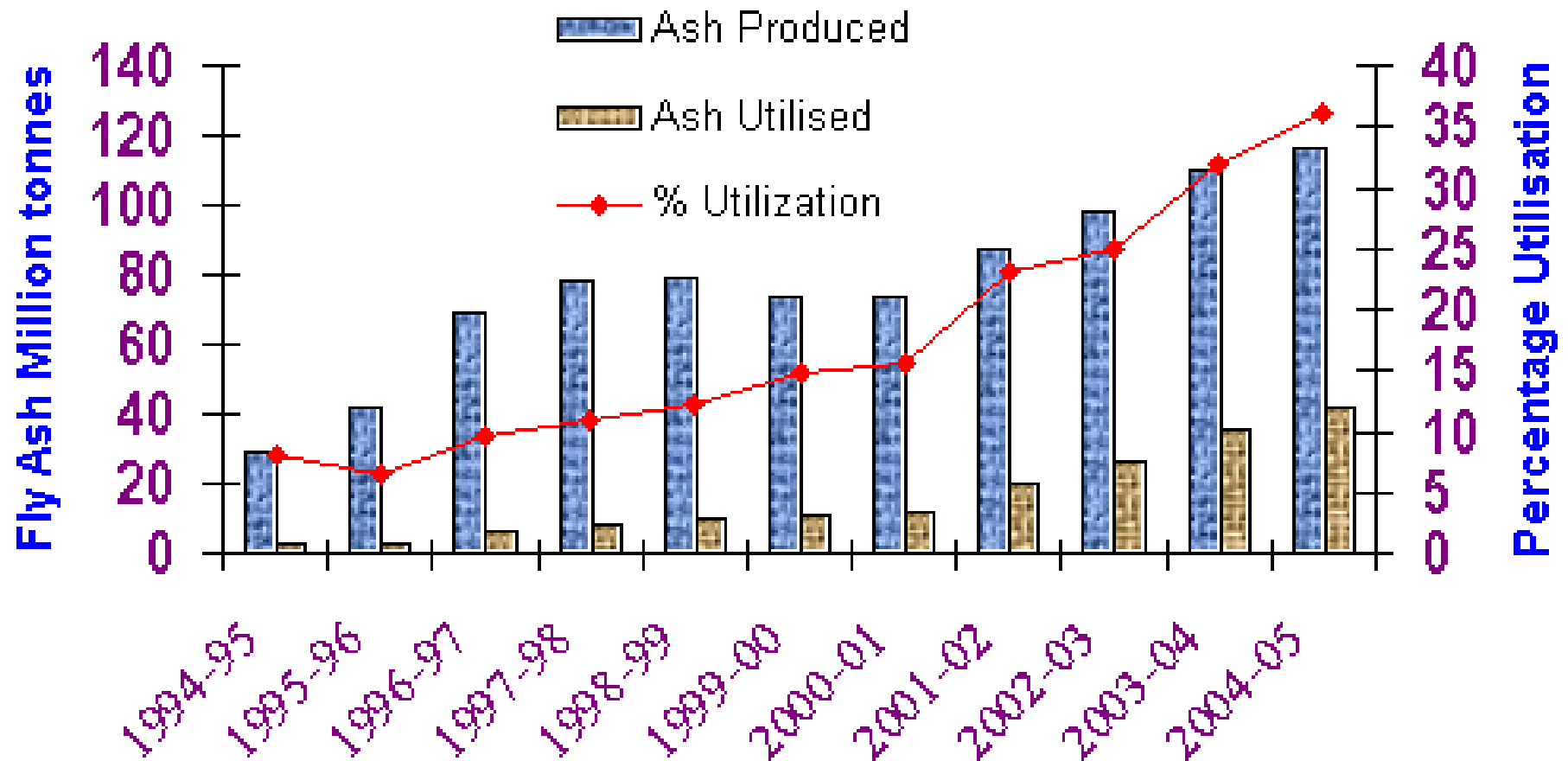
Fly-ash

Fly ash utilization programs:

TIFAC



# Fly ash generation





## ASH SLURRY DISPOSAL SYSTEM

<https://www.mbl.in/ash-slurry-disposal-system>

Slurry formed by mixing water into Bottom Ash, Coarse and Fly ash is pumped to Ash pond by lean phase or dense phase slurry pumping.

### **Lean phase slurry disposal system:**

Ash to Water ratio by weight 1:4, pumping by Centrifugal Pumps.

### **High Density / Concentration Slurry Disposal:**

Ash to Water ratio of 1:0.5 Pumped using positive displacement – Reciprocating Pumps (Piston, Piston Diaphragm or Flushed Plunger type)



## **Ash Slurry Disposal pipeline.**

### **Ash Slurry Pump Series.**

Ash, after mixing with water, is transferred to Ash Slurry Sump for pumping to Ash pond.

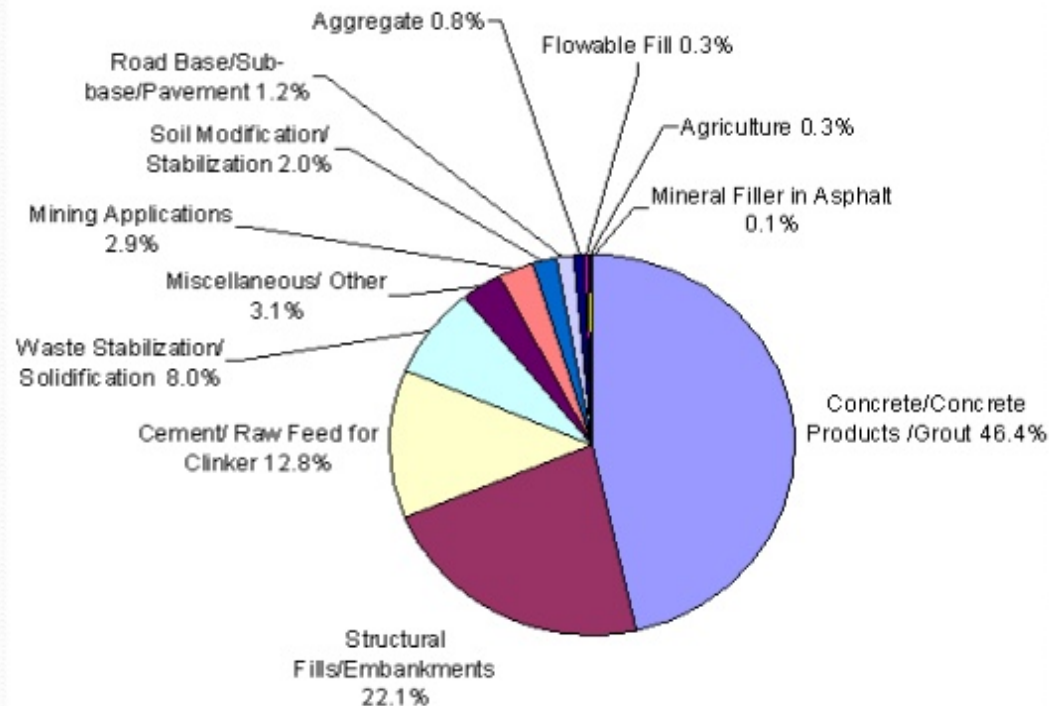
Depending upon the distance of ash pond numbers of pumps are connected in series.

The pumps are provided with highly abrasion resistant material of construction for components which are coming in contact with Ash Slurry and one subjected to high wear and tear.

For safe handling of pumps during maintenance proper handling facilities such as E.O.T. Crane, Semi E.O.T. Crane, Hand operated crane, as may be required, are provided.

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## Fly ash use





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## Utilization

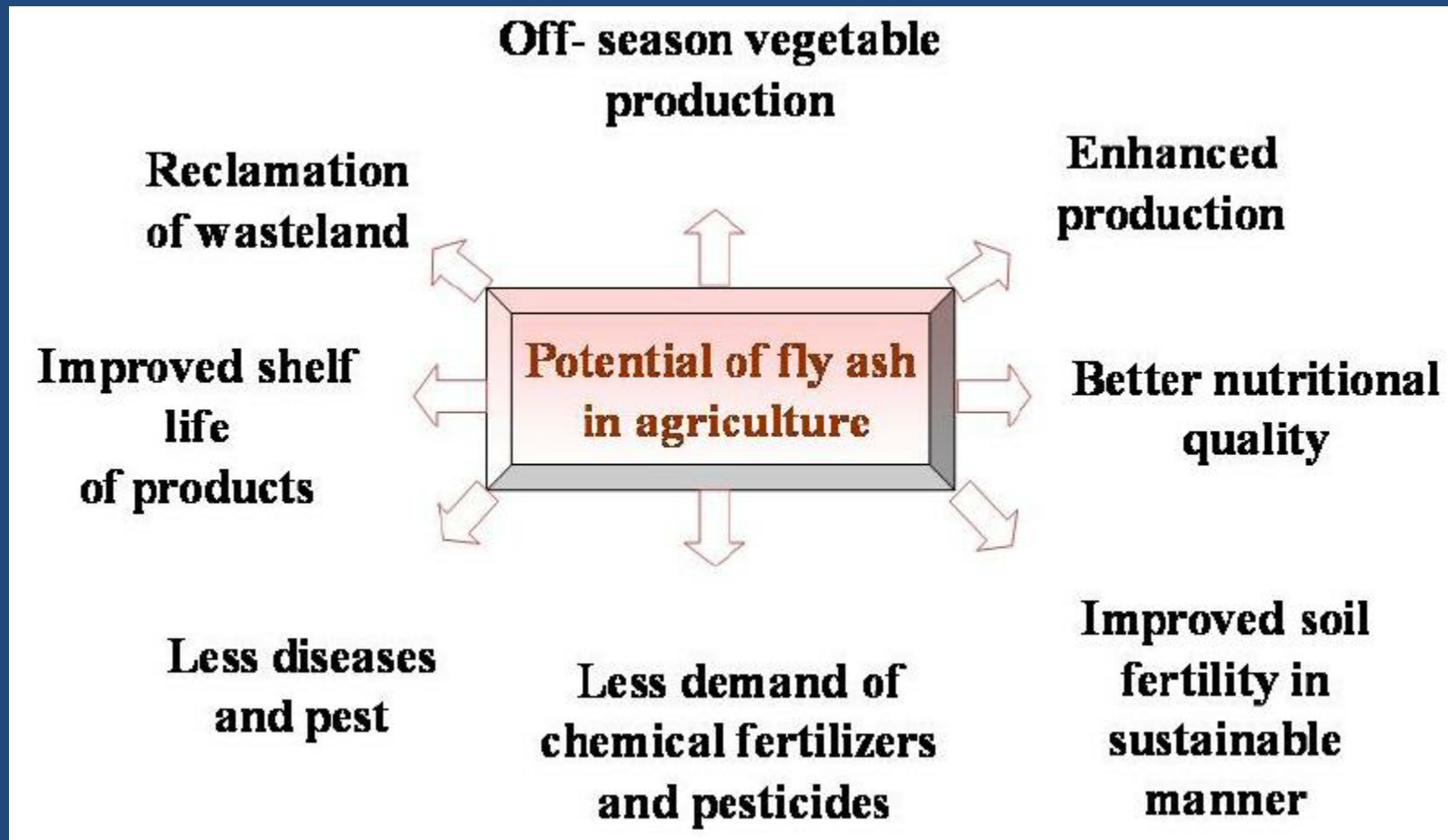
- In developed countries more than 80% Fly Ash is used for the manufacturing following:-

- In agriculture
- Building material
- Bricks construction
- Mine fills
- Metallurgy
- Use of new material
- Environmental control
- Embankment





[https://www.researchgate.net/profile/Seema\\_Mishra2/publication/255947847/figure/fig3/AS:297835296772105@1448020876621/Strategies-for-the-bulk-utilization-of-fly-ash-in-agriculture.png](https://www.researchgate.net/profile/Seema_Mishra2/publication/255947847/figure/fig3/AS:297835296772105@1448020876621/Strategies-for-the-bulk-utilization-of-fly-ash-in-agriculture.png)



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## Utilization

- In developed countries more than 80% Fly Ash is used for the manufacturing following:-

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# Ash bricks

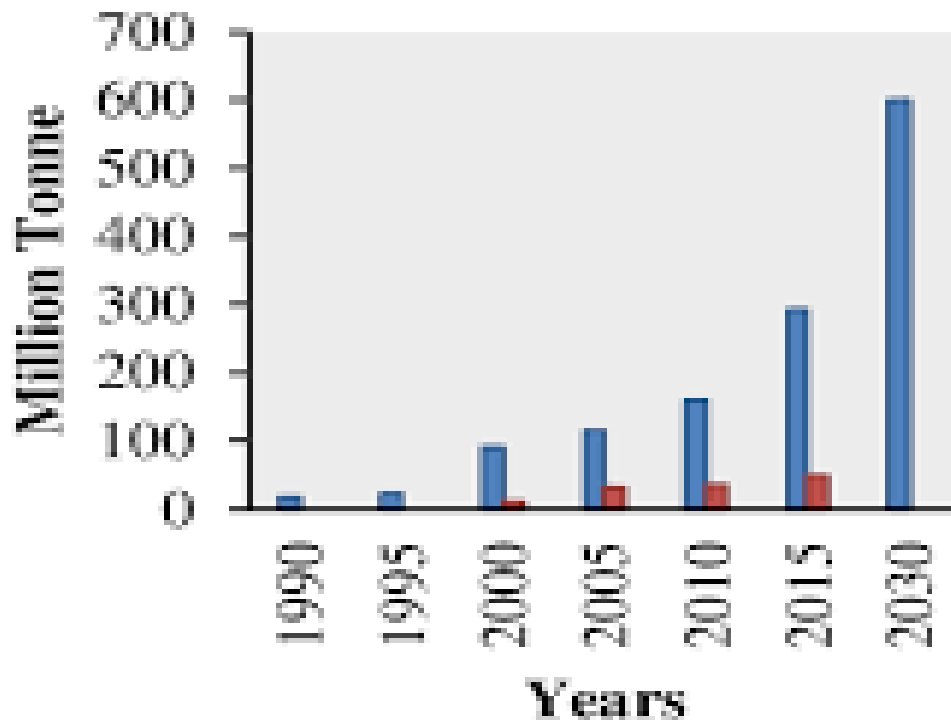
- Compressed at 4,000 psi and cured for 24 hours in a 150 °F (66 °C) steam bath,
- the bricks last for more than 100 freeze-thaw cycles.
- Owing to the high concentration of calcium oxide in class C fly ash, the brick is described as "self-cementing".
- The manufacturing method saves energy, reduces mercury pollution, and costs 20% less than traditional clay brick manufacturing.

S.No	Features	Normal Clay Bricks	Fly Ash Bricks
1	Binding	Light	Dense
2	Colour	Vary	Uniform
3	Shape	Irregular	Uniform
4	Weight	More	Light
5	Compressive strength	35 Kgs / sqcm	100 Kgs / sqcm
6	Thermal conductivity	1.25 -1.35 W / sqm °C	0.90 – 1.05 W / sqm °C
7	Water absorption	20-25%	6-12%



# Scenario in India

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flyAsh production (million tonne)

Fly Ash utilization

# Coal mining and problems

- **Water quality** – Acid run-off and sedimentation from mine sites contaminate waterways and can increase the costs of water treatment systems..
- **Health & Safety Issues** – Abandoned mine sites are froth with high walls, open shafts, dilapidated mine structures and water-filled pits.

These hazards have contributed to **numerous accidents and deaths**, and are especially dangerous for children who find these places interesting to explore.

- **Economic problems** – Abandoned mine lands are often found in economically depressed areas.
- **Esthetic problems** – Abandoned mine sites often have sparse vegetation, stagnant water and many times used as illegal trash dumps.

## Fly ash: coal mine reclamation

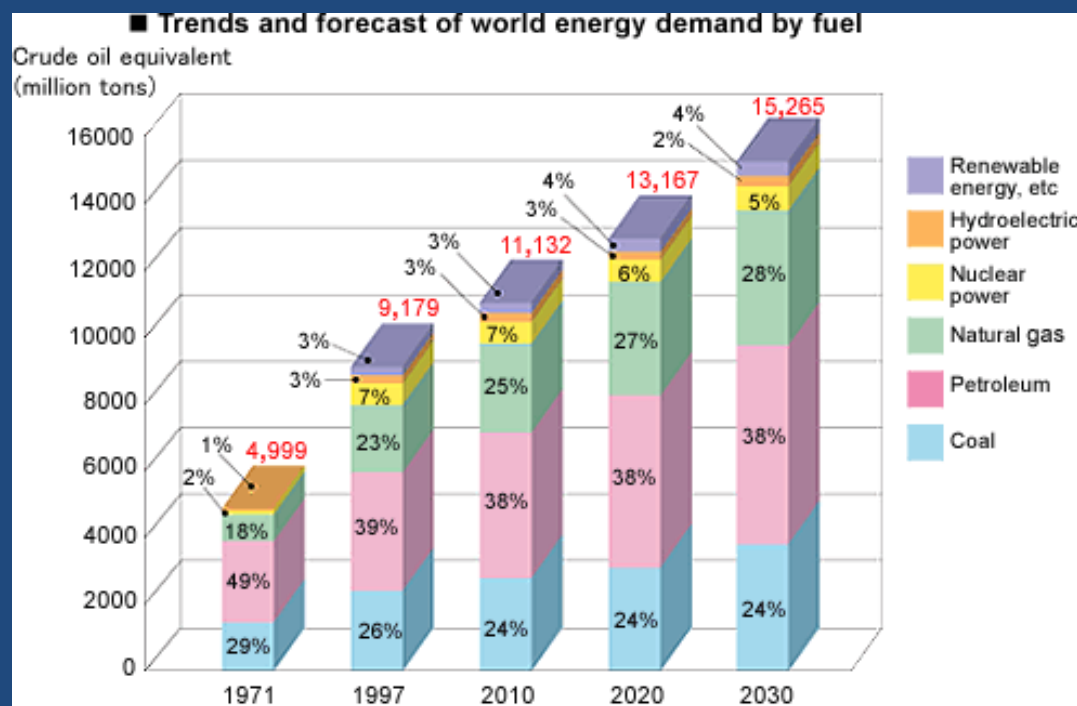
- An **alkaline seal** or **fill material** to contain acid forming materials and prevent the formation of **acid mine drainage**.
- An agricultural supplement to create artificial soil on abandoned mine lands where native soils are not available.
- A flowable fill that **seals and stabilizes abandoned underground mines** to prevent subsidence and the production of acid mine drainage.
- A construction material for dams where such materials are needed to create a compact and durable base.
- A non-toxic fill material for **final pits within the spoil area to reduce reclamation cost**.
- The benefits include improved water quality of lakes and streams, rapid re-establishment of wildlife populations and aquatic habitats, grass lands, and water fowl, stable long term land utilization, and increased land value.
- Perhaps the most important reason to take a proactive reclamation approach is to avoid future liability associated with acidic water discharges, erosion and sediment pollution, subsidence, and other environmental pollution related potentials.





# Global scenario

- 25% rise in consumption / decade
- Energy security
  - Ensuring the continuous availability of commercial energy at competitive prices to support economic growth and meet our energy needs with safe, clean and convenient forms of energy
- Energy mix
- The paradox of fossil fuels
- The Earth summit
- Kyoto protocol



Source: Agency for Natural Resources and Energy (Japan)

# The rising geopolitical battle centered around energy security

- “the Pentagon is itself one of the world's great oil guzzlers, **consuming 134 million barrels of oil in 2005**, as much as the entire nation of Sweden.” by Michael Klare, Professor, Peace and world security studies
- Pentagon uses 0.3 million barrels oil / day
- the U.S. Department of Defense (DOD) is the single-largest consumer of fuel in the world

## Rio Summit, Earth Summit

- **The United Nations Conference on Environment and Development (UNCED)**
  - [Rio de Janeiro](#) from [June 3](#) to [June 14, 1992](#).
  - Participants: 172 governments, 108 heads of state, 2,400 representatives of (NGOs), 17,000 people who had [Consultative Status](#).
  - Agenda-21-blue print for action.
  - UNFCC
    - United Nations Framework Convention on Climate Change



# Kyoto protocol

- The objective
  - To achieve "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system"
- The treaty negotiated in [Kyoto, Japan](#) in December 1997
  - Opened for signature on [March 16, 1998](#),
  - Closed on March 15, 1999.
  - The agreement came into force on [February 16, 2005](#)
- Total member countries / signatories
  - Nov 2007-175 → 191 - As of July 2010 → 184 – Ratified prior to Copenhagen → 193 – Ratified currently Feb 2012
  - India ratified in 2002
- *The agreement*
  - *Under which industrialized countries will reduce their collective emissions of [greenhouse gases](#) by 5.2% compared to the year 1990.*
  - *The six greenhouse gases - [carbon dioxide](#), [methane](#), [nitrous oxide](#), [sulfur hexafluoride](#), [hydrofluorocarbons](#), and [perfluorocarbons](#)*

# Kyoto protocol

- The issues addressed:
  - Systematic **scrutiny of patterns of production** — particularly the production of toxic components, such as lead in gasoline, or poisonous waste
  - **Alternative sources** of energy to replace the use of fossil fuels which are linked to global climate change
  - New reliance on public transportation systems in order to reduce vehicle emissions, congestion in cities and the health problems caused by polluted air and smog
  - The growing scarcity of water

# Important achievements

- Sets **binding targets** for 37 industrialized countries and the European community for reducing greenhouse gas (GHG) emissions
- Agreements on
- Climate Change Convention
- "not carry out any activities on the lands of indigenous peoples that would cause environmental degradation or that would be culturally inappropriate

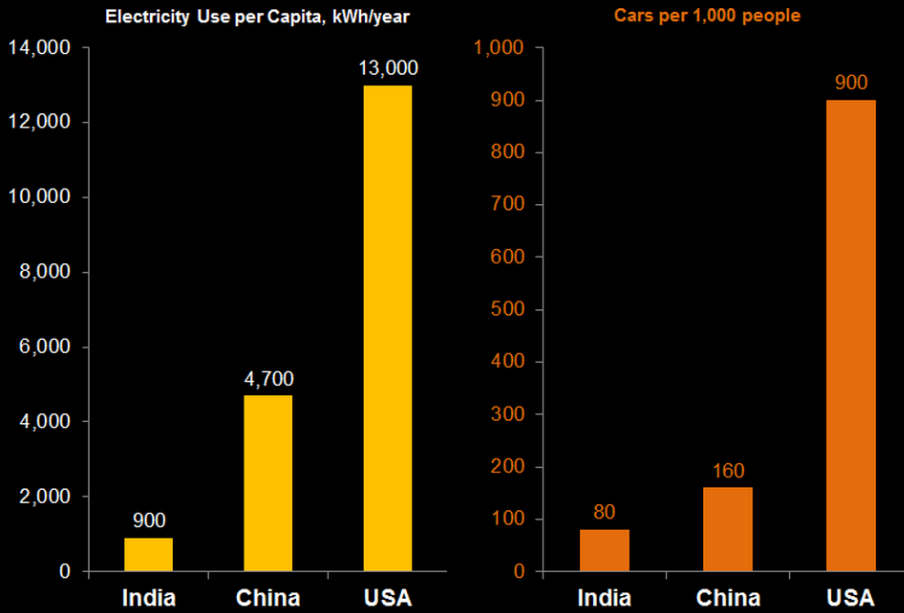


- *National limitations*
  - *European Union - 8% reductions*
  - *US - 7%*
  - *Japan - 6%*
  - *Russia - 0%*
- *Maximum beneficiaries*
  - *Australia - 8%*
  - *Iceland - 10%*
- *Developing countries*
  - *No numerical limitation*
  - *Not the main contributors to the greenhouse gas emissions during the pre-treaty industrialization period.*
  - *Share common (but differentiated) responsibility*
    - *Monitoring and reporting emissions*

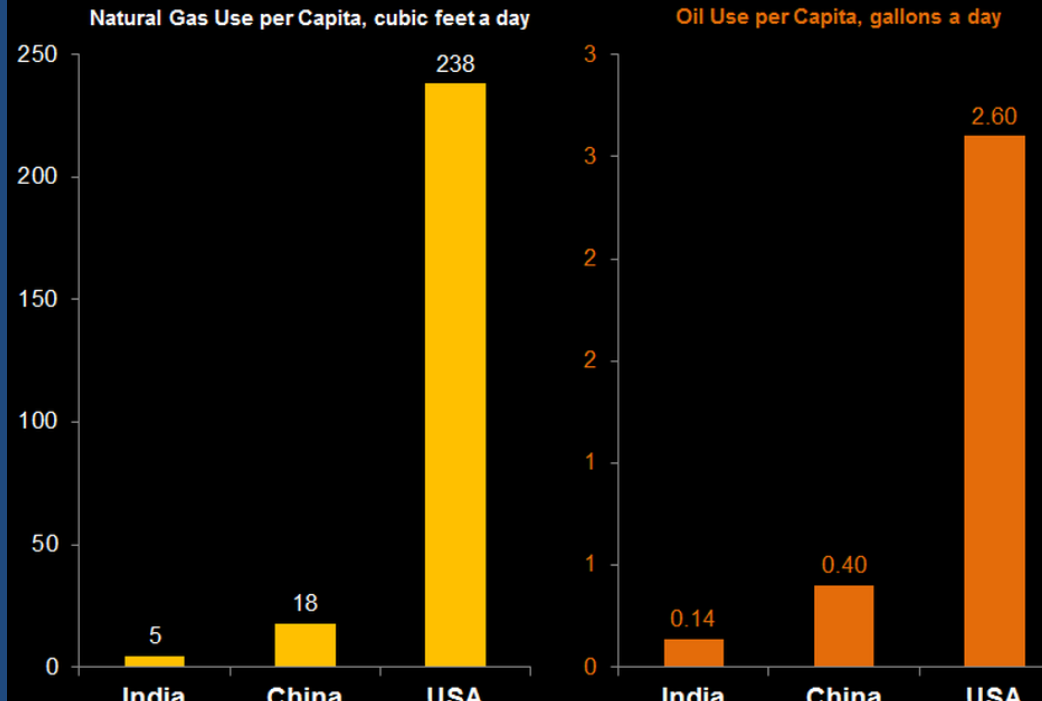


June, 2018, Forbes  
magazine

## Indians and Chinese Use Far Less Electricity, Have Less Cars Than Americans



## Indians and Chinese Use Far Less Natural Gas And Oil Than Americans



- **Monitoring emission targets**
  - Under the Protocol, country's' actual emissions have to be monitored and precise records have to be kept of the trades carried out.
- The Kyoto mechanisms are:
  - Emissions trading – known as “the carbon market”
  - Clean development mechanism (CDM)
  - Joint implementation (JI)

- The Intergovernmental Panel of Climate Change
- Established by
  - the [United Nations Environment Programme](#) (UNEP) and the [World Meteorological Organization](#) (WMO)
- AIM:
  - to provide the world with a **clear scientific view** on the current state of climate change and its potential environmental and socio-economic consequences.
- FEATURES & FUNCTIONS
  - A **scientific body**.
  - an **intergovernmental body**, and it is open to all member countries of UN and WMO
  - **Reviews and assesses** the most recent scientific, technical and socio-economic information produced worldwide relevant to the understanding of climate change.
  - Thousands of scientists from all over the world contribute to the work of the IPCC on a voluntary basis. **It does not conduct any research** nor does it monitor climate related data or parameters.
  - The IPCC Bureau and Chairperson are also elected in the plenary sessions.
  - The work of IPCC is **policy-relevant and yet policy-neutral, never policy-prescriptive**.

Climate Change First Became News 30 Years Ago. Why Haven't We Fixed It?  
**In the time it took to build the case that climate change is a pollution problem, it's become unnervingly more than that.**

THIRTY YEARS AGO, the potentially disruptive impact of heat-trapping emissions from burning fossil fuels and rain forests became front-page news. It had taken a century of accumulating science, and a big shift in perceptions, for that to happen. Indeed, Svante Arrhenius, the pioneering Swedish scientist who in 1896 first estimated the scope of warming from widespread coal burning, mainly [foresaw this as a boon](#), both in agricultural bounty and “more equable and better climates, especially as regards the colder regions of the Earth.”

There were scattered news reports through the decades, including a remarkably clear 1956 [article in the New York Times](#) that conveyed how accumulating greenhouse gas emissions from energy production would lead to long-lasting environmental changes. In its closing the article foresaw what's become the main impediment to tackling harmful emissions: the abundance of fossil fuels. “Coal and oil are still plentiful and cheap in many parts of the world, and there is every reason to believe that both will be consumed by industry so long as it pays to do so.”

<https://www.nationalgeographic.com/magazine/2018/07/embark-essay-climate-change-pollution-revkin/>

# Post Kyoto protocol

- Steps forward...
  - Bali Action Plan (2007)
  - **Nairobi work programme**
  - **National Adaptation Programmes of Action** for least developed countries
- Or backward...?
  - January 29 2002 - the new liberal/conservative Danish government
  - All R&D programmes, financial support, committees, government agencies etc that for 20 years have been crucial in the development of renewable energy will immediately be cancelled or dissolved.
  - The government will spend the money saved (20 million EURO) on hospitals and senior citizens



# UNFCCC conference in Copenhagen, Denmark

## December 7-18, 2009



- HINT OF POSITIVENESS

- The BASIC group has emerged as a powerful force in climate change negotiations
- A **legally non-binding agreement** is drawn up
- A limit for global temperature increase set at **2°C**
- Developed countries committed to provide **financial assistance** up to \$30 billion for the period 2010-2012 to aid in efforts of climate change for **least developed** countries
- Incorporated **punitive measures** for those countries that do not adhere to carbon emission targets

# Copenhagen Accord – Behind closed doors....?

- SOME POINTS OF THE ACCORD....
- We underline that climate change is one of the greatest challenges of our time. We emphasise our **strong political will** to urgently combat climate change
- We agree that **deep cuts** in global emissions are **required**
- Adaptation to the adverse effects of climate change and the potential impacts of response measures is **a challenge** faced by all countries
- We recognize the crucial role of **reducing emission** from deforestation and forest degradation
- **Developing countries**, especially those with low emitting economies should be provided **incentives** to continue to develop on a low emission pathway.
- Scaled up, new and additional, predictable and **adequate funding** as well as improved access shall be provided to developing countries, in accordance with the relevant provisions of the Convention