Energy Conservation

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Energy

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Energy Sources

Non Renewable

1. Coal
2. Oil
3. Gas
4. Nuclear

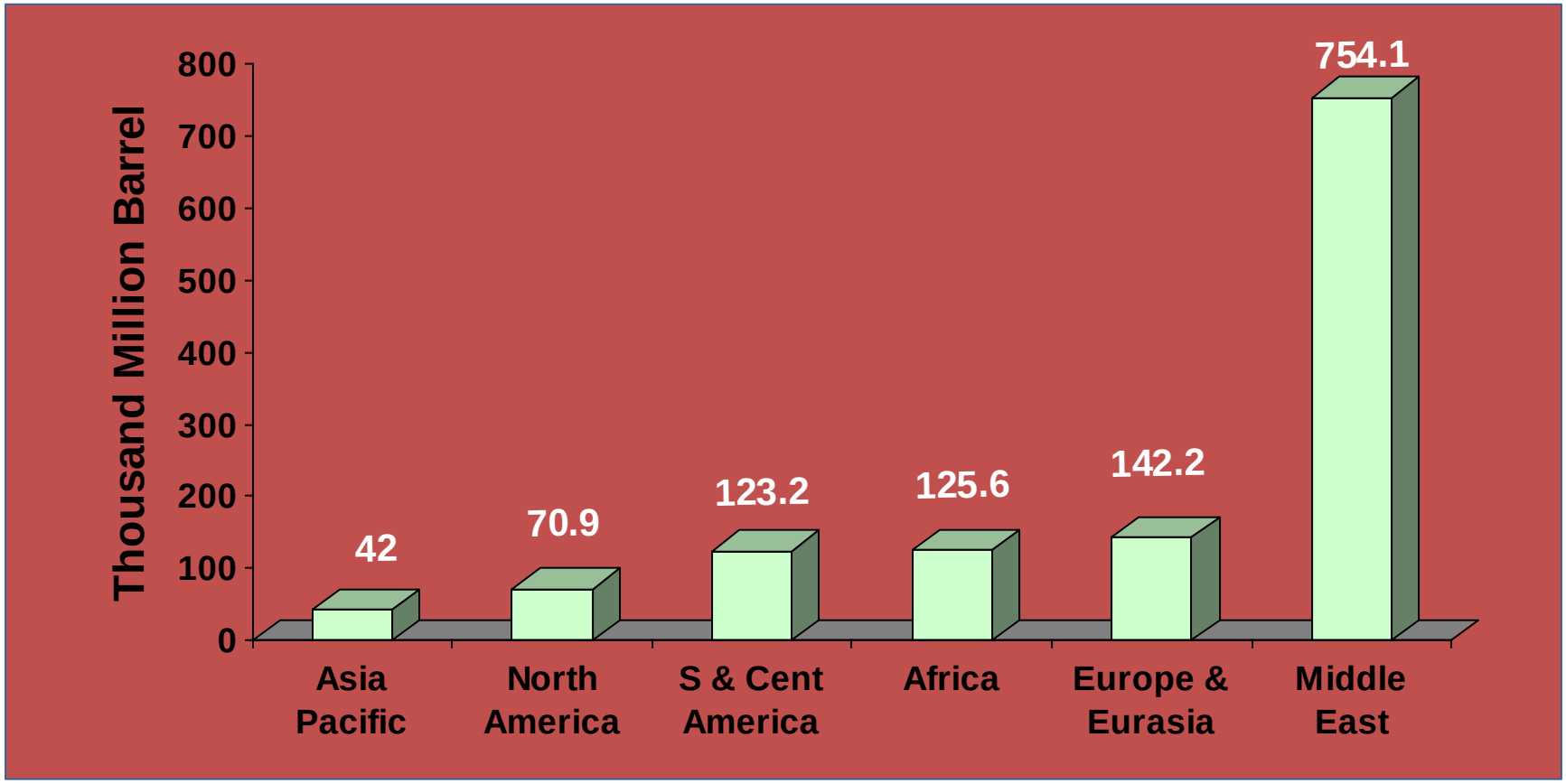
Renewable

1. Solar
2. Wind
3. Hydroelectricity
4. Biomass etc.

Reserves Status

World Proven Reserves of Crude Oil : 1408.7 Thousand Million Barrels

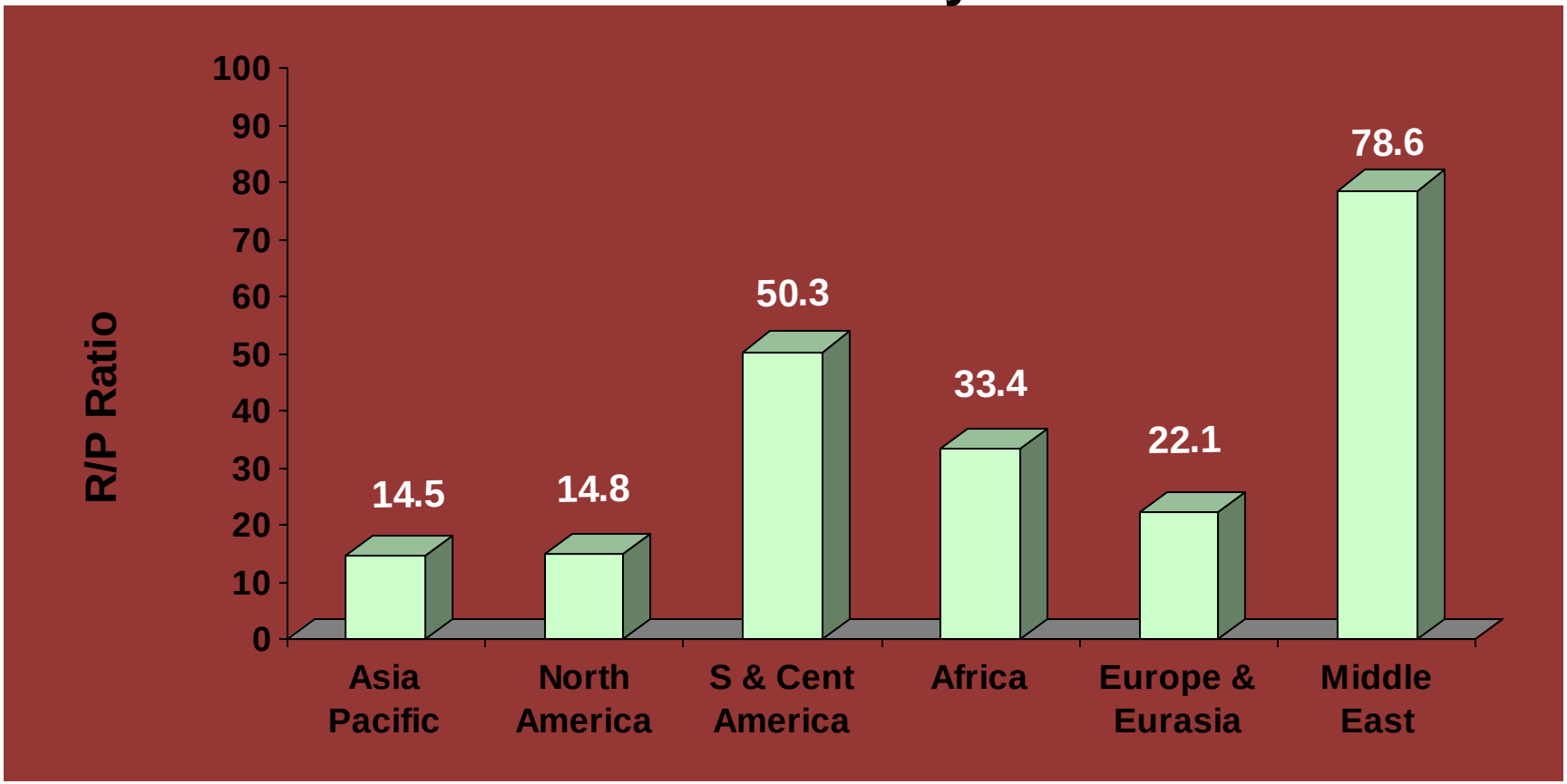
India's Proven Reserves of Crude Oil: 5.8 Thousand Million Barrels

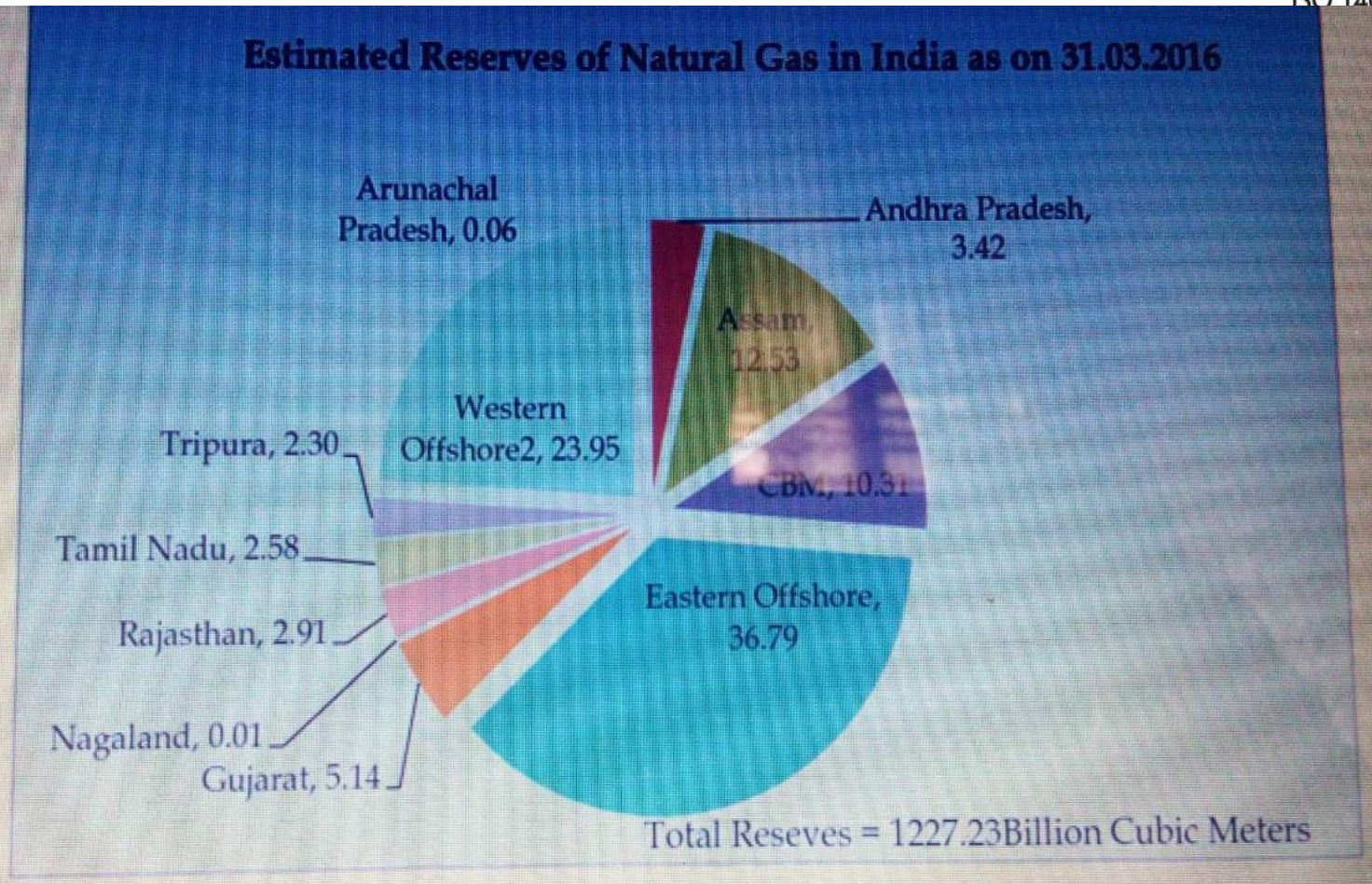


Reserves/Production Status

World Proven R/P of Crude Oil : 42 yrs

India's Proven R/P of Crude Oil: 20.7yrs





- The estimated reserves of Natural Gas decreased by 1.97% over the last year. The maximum contribution to this decrease has been from Western Offshore, followed

Primary Energy Consumption

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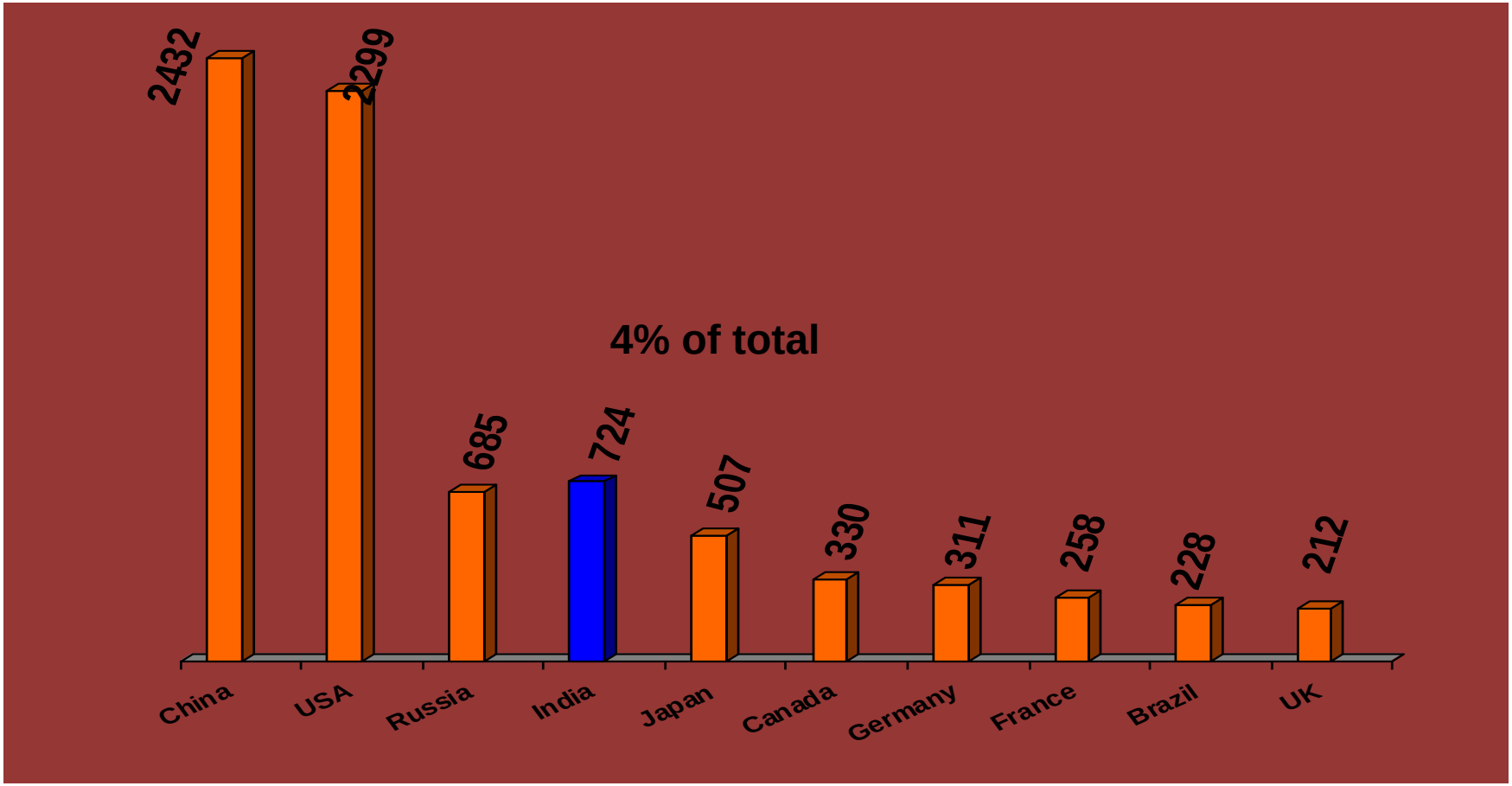
India:

- **At 724 MMTOE, 3rd largest consumer of primary energy**
- **One of the largest growing market for energy**



Country-wise primary energy consumption MMTOE

India's Energy Basket

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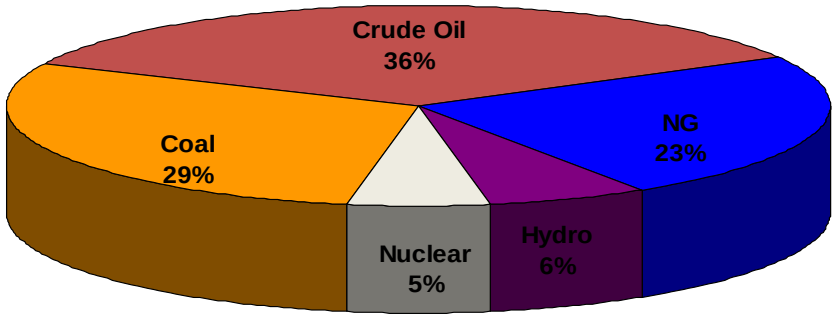
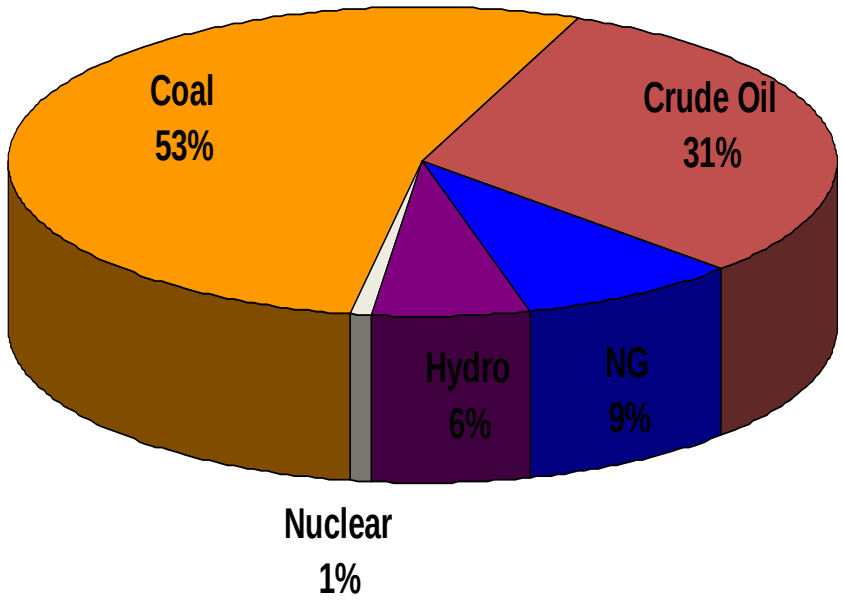
Primary Energy

World Energy Consumption: 11,299 MTOE



India Energy Consumption: 724 MTOE



Oil Consumption

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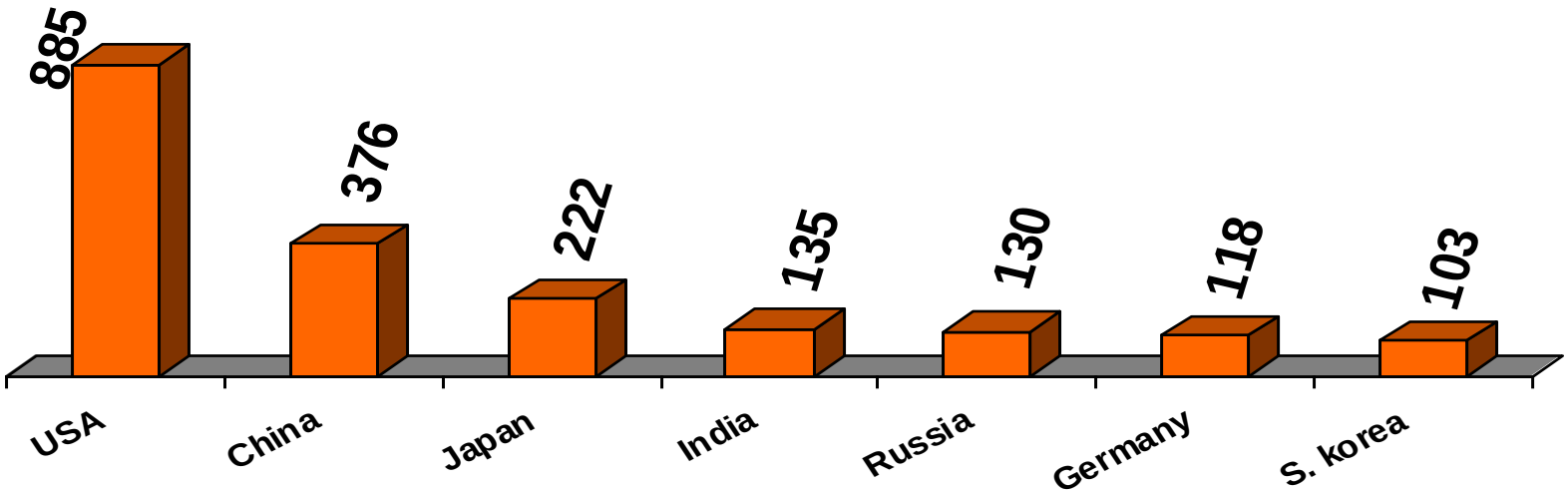
World oil consumption 3,928 MMT

India 4th largest consumer of oil : 135 MMT(3.4% of total)

India's Oil consumption increased at 4% (decade after 1998) against the world of 1.4 %.



Country-wise oil consumption MMTOE

-India’s energy consumption is set to grow 4.2% a year by 2035, faster than that of all major economies in the world, according to BP Energy Outlook.

- India’s energy consumption grows the fastest among all major economies by 2035. As a result, the country remains import dependent despite increase

- Indias share of global energy demand to rise to 9% by 2035 from present 4%, Indias dependence on imports will only increase, so oil imports to increase by 156% followed by gas imports at 173%

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Energy outlook

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For India, sourcing of Energy remains a challenge…..

- **with 16% of Global Population;**
- **0.5% of world's Petroleum Reserve;**
- **10% of world's coal reserves;**
- **7-8% GDP growth target;**

Indigenous crude

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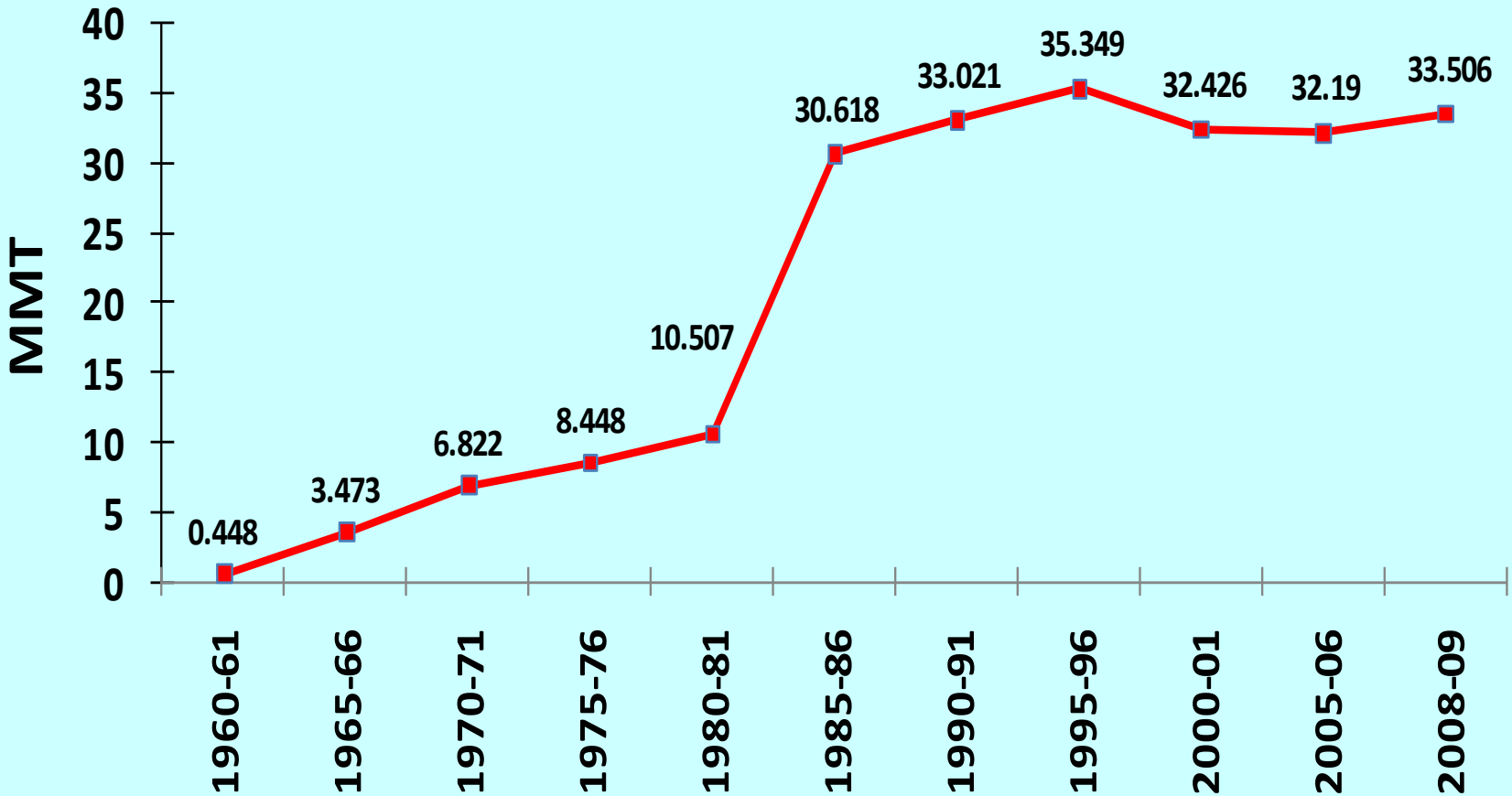
Domestic Crude Oil Production Trend



Source: Planning Commission & TERI Data Book

Why energy efficiency? II

- India is also highly dependent on imported oil to meet the energy demand, which raises the question of energy security of the nation.
- Immense potential exists in this aspect of energy efficiency, particularly in the use of pumps, heating, ventilation, air conditioning & lighting areas and Industrial sectors

Why We Should Save Energy

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- Think about what would happen if there wasn't enough energy……

Here are the biggest reasons why it is important to be **energy**-conscious and make every effort to **conserve** energy … can **save** you money. Limited resources of fossil fuels... Fossil fuels are not a clean source of **energy** either. less pollution and reduce greenhouse gas emissions

ENERGY CONSERVATION IN GLASS INDUSTRY

Point No. 1 – Energy Conservation (Scientific Concept)

Point No. 2 – Requirement of Energy

Point No. 3 – Energy Efficiency of Mfg. Processes

Point No. 4 – Energy Conservation (Practical aspects)

Point No. 5 – Concept of Energy Conservation

Point No. 6 – Raw Materials of Glass

Point No. 7 – Steps Involved in Glass Manufacturing

Point No. 8 – Important Factors at Different Steps

Energy Conservation (Scientific Concept)

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1. Total energy of the Universe is conserved i.e. Energy can neither be created nor destroyed. Only its forms are interchanged.
2. However for all practical purposes ‘Energy Conservation is referred to as Energy Saving
3. Change of form of energy is an irreversible process i.e. once one form of energy is changed to the other it cannot be brought back to its original form

5. There may be several sources of naturally available energy like Solar Energy and Hydro Energy, but they may be difficult to use & control.

6. In general fuels are of two types – the Fossil Fuel and the Nuclear Fuel.

7. Fossil fuels are safe for use with nominal care but Nuclear fuel warrants extreme care in use.

8. Fossil fuel reserves are deposits of natural vegetation millions years back and limited, and cannot be replaced easily in short period.

9. Therefore fossil fuel should be used with utmost wise so that it may be available for future use.

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Requirement of Energy

1. All scientific processes are energy dependent.
2. However all the scientific processes are not equally and optimally energy efficient.
3. Efforts are being continuously made globally to bring energy efficiency of the processes higher and higher.
4. Global efforts made in past two decades towards enhancement of energy efficiency have resulted in reduction by 50% of current total energy requirement
5. Still there is a wide scope of improvement in majority of areas and further efforts are continued too.

Energy Efficiency of Manufacturing Processes

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1. Man is highly innovative and inventive to process naturally available things or to make (manufacture) new things for ease, safety and betterment of life.

2. The first activity needs little energy but the second a lot.

3. Energy requirement in manufacturing vary from article to article and the variation is quite wide.

4. Efficiency of manufacturing processes too is quite varying. Some processes require low energy whereas some require very high.

5. High temperature manufacturing processes need higher amount of energy.

6. Glass manufacturing is one of the high temperature manufacturing processes.

7. Nature of the material glass is altogether different from other materials in the sense that it is a liquid in the form of solid.

Energy Conservation (Practical aspects)

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1. As discussed above, scientifically 'Overall energy of the universe is conserved' – Law of Conservation of Energy

2. But in manufacturing process by the term Energy Conservation we mean energy utilization or directly we can call it "Energy Efficiency."

3. Energy Efficiency is the ratio of Energy utilized to the Total energy consumed.

4. Energy consumed in any process comprises of two parts viz. (i) the theoretically required part and (ii) the supporting part (necessary to bring about out the desired change(s) during the process.

5. Theoretical part is constant.

6. So for improving Energy Efficiency all efforts have to be concentrated on reducing the support energy.

Concept of Energy Conservation

1. Generally for reduction of support energy requirement attention is mostly paid on merely three events viz. (i) Combustion Control, (ii) Radiation Control and (iii) Waste Heat Recycling, all the components of Furnace (Design & construction and operation) directly and highly related to energy efficiency.

2. But this is only Extensive Approach.

3. Intensive Approach suggests that Actual Energy Efficiency is the ratio of theoretical requirement of energy for manufacturing of packed product to the total energy consumed.

4. Hence Energy Conservation must include efforts to get highest **Packing Ratio** which is termed as **Productivity**.

5. *For highest Productivity, attention must be paid to each and every manufacturing step responsible for reduced productivity, irrespective of contribution of the part of the energy required for the step to the total energy requirement.*

Composition & Raw Materials of Glass

- Over 90% of the glass we see is Soda-lime glass.
- A typical Composition of Soda-lime glass is as under:

Constituent	(Chemical Name)	Content (%)
SiO_2	(Silicon Di-oxide / Silica)	71- 72
Al_2O_3	(Aluminum Oxide/ Alumina)	02.0
Fe_2O_3	(Ferric Oxide/ Iron Oxide)	00.11
Na_2O	(Sodium Oxide/ Soda)	14 – 15%
K_2O	(Potassium Oxide/ Potash)	00.50
CaO	(Calcium Oxide/ Lime)	08.00
MgO	(Magnesium Oxide/ Magnesia)	01 – 04%
BaO	(Barium Oxide/ Barium)	00.78
B_2O_3	(Boric Oxide)	01.36

Raw Materials for Glass

S. No.	Raw material	Contribution
1	Quartz Sand/ Silica Sand	SiO_2
2	Soda Ash	Na_2O
3	Potassium Carbonate	K_2O
4	Calcite/ Lime Stone/ Marble	CaO
5	Borax	B_2O_3 and Na_2O
6	Arsenic Trioxide	As_2O_3
7	Sodium Sulphate	Na_2O
8	Red Lead	PbO
9	Feldspar	Na_2O/K_2O, SiO_2, and Al_2O_3
10	Barium Carbonate	BaO
11	Potassium /Sodium Nitrate	K_2O/Na_2O
12	Barium Carbonate	BaO
13	Dolomite	CaO, MgO

Steps Involved in Glass Manufacturing

Major steps involved in glass manufacturing are:

1. Selection & Procurement of Raw materials
2. Beneficiation & Storage of Raw materials
3. Selection, Beneficiation & Storage of Cullet
4. Quality Control (laboratory testing) of Raw Materials and Cullet
5. Preparation of Glass Batch
6. Storage & Transportation of Glass Batch

7. Feeding of glass batch into the Melting Furnace (Charging)
8. Melting of batch into ‘Molten Glass’
9. Refining & conditioning of molten Glass
11. Shaping of molten glass (Glass Forming)
12. Annealing of Glass ware
14. Inspection& Transfer to warehouse.

Raw materials

- Selection – Specification of Raw Material in terms of Chemical composition and Physical properties
- Procurement – Confirmation of specification of received materials to that of required/ quoted.
- Beneficiation – In respect of grain size & contamination
- Storage – In respect of contamination

Cullet

- Selection – In respect of Grade & Composition
- Beneficiation – In terms of contamination & Size
- Storage – In terms of Contamination

Quality Control (laboratory testing) of Raw Materials and Cullet in terms of consistency.

Glass Batch

- Preparation – In confirmation to batch composition, correct & sequential weighing of raw materials, Homogeneous mixing of batch material and addition of cullet
- Storage – In terms of retention time of batch
- Transportation – In terms of vibration
- Charging – In terms of Charging Schedule and Thickness of Batch pile

Melting, Refining & Conditioning

- Melting – Time-temp. treatment of batch to make 'Molten Glass', Combustion Control, Waste Heat Recovery and Radiation Control
- Refining – Time–temp. treatment of molten glass
- Conditioning – Conditioning schedule

Shaping/ Forming

- Glass Gathering – In terms of Viscosity
- Shaping – In terms of design of ware and process applied for
- Transfer to Annealing Oven/lehr

Annealing, Inspection & Transfer

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- Annealing – In terms of **ANNEALING SCHEDULE**
- Inspection – In terms of defects
- Transfer to warehouse – In terms of safety

Where are the opportunities to save energy

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- Recover & utilize waste heat from furnace flue gas for preheating of combustion air. Every 21°C rise in combustion air temperature results in 1% fuel fuel savings.
- Control excess air in furnaces. A 10% drop in excess air amounts to 1% saving of fuel in furnaces. For an annual consumption of 3000 kl. of furnace oil. This means a saving of Rs 7.5 Lacs. (Cost of furnace oil-Rs. 25 per litre).
- Reduce heat losses through furnace openings. Observations show that a furnace operating at a temperature of 1000°C having an open door (1500mm*750mm) results in a fuel loss of 10 lit/hr. For a 4000 hrs. furnace operation this translates into a loss of approx. Rs. 10 Lacs per year.

Where are the opportunities to save energy

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- Improve insulation if the surface temperature exceeds 20°C above ambient. Studies have revealed that heat loss form a furnace wall 115mm thick at 650°C amounting to 2650 Kcal/m2/hr can be cut down to 850 kcal/m2/hr by using 65 mm thick insulation on the 115 mm wall.
- Ceramic coatings as insulation
- Proper design of lids of melting furnaces and training of operators to close lids helps reduce losses by 10% in foundries.

Energy conservation in industry - Gist

New approach

Industrial furnaces are to be analysed continuously to identify optimization potentials

Auditing

Process modification (LEM, Air cooled coolers, HRA)

Energy efficient equipments, improved measuring equipments

Energy loss reduction

Waste heat recovery -- Batch and Cullet preheat,

**energy benchmarking of industrial furnaces and their processes is a necessary task

**Alternative Fuels – cofiring approach – Biogas,

Conclusion

- Energy consumption is an indicator of any country's prosperity
- Conservation doesn't mean – " No use of energy" rather it indicates – " Efficient utilization of Energy"
- One unit of energy saved at end-use is equivalent to Four units of Energy at upstream end
- **Energy is in short supply in India and is expensive especially for industry .**
- **Management of energy resources is important part of power system so as to save natural resources, the conservation of natural resources has to be done at different levels, socially and commercially ….**
- **With the use of more energy efficient technologies and innovations industries could cut down their energy consumption up to 20%**

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Thank You

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