Economic Geography

DEVELOPMENT & GROWTH

INTRO:- The term 'development' in economics, is today an overused term when it comes to analysis and policy making. Interestingly, the meaning generally attached to the has not come as easily as it seems to be. This meaning has been consistently evolving from terms such as progress, growth and development itself. 'Progress' is a general term frequently used by experts to denote betterment or improvement. In economics, the term was used for a longer period to show the positive movement in the lives of the people as well as economy. It had both the quantitative and qualitative aspects to it.

After a point of time, some economics began using all three terms — progress, growth and development - interchangeably, to mean almost the same thing. It was only during the three decades of 1960s, 1970s and 1980s, that the clear meanings we attach to

these terms today. 'Progress' became a generic term in economics with no specific meaning, and denoted both growth and development. However 'growth' and 'development' were respectively alloted clear-cut meanings.

GROWTH:- Economic growth refers to an increase in economic variables over a period of time. The term may be used in in individual cases or with reference to an economy, or for the whole world. The most important aspect of growth is its quantifiability i.e. it can be measured in absolute terms. Here, all the units of measurement may be applied depending upon the economic variable. A few examples are given:-

i) growth in food production of an economy during a particular decade may be measured in tonnes.

ii) Similarly, for a given economy, the value of its total production may be measured in currency terms and could indicate economic growth.

iii) Growth in the per capita income of an economy may be measured in monetary terms over a period.

It can thus be said that economic growth is quantitative progress. Though growth is value neutral term i.e. it might be positive or negative for an economy for a period, it is generally referred to in the positive sense. If economists say that the economy is growing, it means that economy has a positive growth (otherwise they would specifically use the term 'negative growth').

DEVELOPMENT

[For a considerably longer period, the main issue discussed by the economists was how to increase the quantity of

production as well as the income of a kingdom or a nation state. Previously, It was believed that once an economy was able to increase its production, its income would also increase and there would be an automatic betterment (quality increase) in the lives of the people of that economy.

It was during 1960s and in the decades that followed that economists came across many a country wherein growth was comparatively higher but the quality of life was comparatively lower. It was about that time, economic development was defined differently from what the world referred to as economic growth. For economists, development indicated the quality of life in an economy which may be seen in accordance with the availability of many variables, such as:

i) Level of nutrition

ii) Expansion and the reach of healthcare

facilities — hospitals, medicines, fresh drinking water, vaccination, sanitation etc.

iv) other such variables on which quality of life depends.

Here, it is important to note that if people are to be guaranteed a basic minimum level of quality-enhancing inputs (variables such as food, health, education etc.) in their lives, then they also have to be guaranteed a minimum level of income. Meaning it is necessary to ensure growth before assuring development.

Yet this does not mean that higher economic growth automatically brings about higher economic development. Economists observe the first such instance of growth without development in the gulf countries. Although these economies displayed far higher levels of income and growth, the respective levels of development were not comparable. Thus came into being

that branch of economics which was to be known as 'development economics'

Thus it can be said that economic development is quantitative as well as qualitative progress in an economy. Meaning the term 'growth' implies quantitative progress and the term 'development' refers to quantitative as well as qualitative progress. If, economic growth is suitably used for development, it comes back to accelerate the growth of that economy (country) and, ultimately, larger and larger population can be brought under this arena of development.

Thus, there is a circular relationship between growth & development. This relationship broke down as the Great Depression came in. After the concept of 'Welfare State' was established, development became a highly serious matter of concern for the govts across the world. Gradually an entirely new branch of economics welfare Economics was born out of the concept of Welfare State and the immediacy of development.

Measuring development :-

While international bodies such as the UNO, IMF and WB were concerned about the development of the comparatively underdeveloped regions of the world, any attempt in this direction was only possible once there was a tool to know and measure development was available. The idea of developing a formula/method to measure the development was facing basically two kinds of difficulties.

1) At one level it was difficult to define what constitutes development. The factors which indicated development were many — level of income/consumption, quality of consumption, healthcare, nutrition, safe drinking water, literacy and education, social security, entertainment, pollution-free environment, etc. It was a difficult task to achieve consensus among the experts on these determinants of development.

2) At second level, it was difficult concept to quantify considering, development constitutes quantitatives as well as qualitative aspects

HDI

Significantly then, the United Nations Development Programme (UNDP) produced an annual report on the human dimension of development and published the Human Development Report 1990 (HDR). First of its kind, this report had a Human Development Index (HDI) which attempted to define and measure the levels of development. The first such team, which developed the HDI, was led by Mahbub UL Haq & Amartya Sen and Inge Kaul. The term 'Human Development' is a corollary of 'development' in the index.

HDI went on to select three broad parameters, alloted them equal weightage and measured the development of the countries -

1) Standard of living :- to be indicated by per capital gross national income (GNI) adjusted for the differing purchasing power parity (PPP) in the US dollar. Earlier it was calculated at the GDP which was changed in 2010.

ii) Knowledge :- to be measured by indicators related to the level of education -

a) Mean of years of schooling (for adults aged 25 yrs)

b) Expected years of schooling (for children of school entering age)

iii) Life Expectancy :- To be calculated at the time of birth.

According to UNDP :- on a scale of (0.0 - 1.0) point

i) High Human Development Countries :- 0.8 - 1.0

ii) Medium Human Development Countries :- 0.500 - 0.799

iii) Low Human Development countries :- 0.000 - 0.499

GROSS NATIONAL HAPPINESS :-

Bhutan, a relative economic non-entity developed a new concept of development in the early 1970s - Gross National Happiness. Without rejecting the idea of human development pronounced by UNDP, Bhutan has officially been following the targets set by GNH since 1972 and adheres to the following parameters - i) Higher real per capita income

ii) Good governance

iii) Environmental protection

iv) Cultural promotion (i.e. inculcation of ethical and spiritual values in life without which, it says, progress may become a curse rather than a blessing.

Following the 2001, terrorist attack on the World Trade Centre in the US, the world seems to have undergone a psychic metamorphosis. The euphoria of development has been shaken at its very base, and the world - in the midst of globalisation - is now introspecting whether multicultural co-existence is possible! HDR-2005 was ironically titled 'Multicultural Co-existence'.

Mankind is passing through a phase of introspection and transition wherein the dominant view of the world may metamorphose into redefining the very idea of development to include both ethical values and spiritualism. Yet, till date, the proponents of development are wary of believing and accepting the non-material site of life which, too, needs to be realised if development were to result into happiness.

Problems of Economic Development :-

Development is a relative term. Not all indicators of development are widely present everywhere. The process that development is also in various stages in different parts, and so is the problem faced by the development. The problems in economic development can be best expressed as problems of differential development or problems of unbalanced growth.

Reasons for Unbalanced Economic Development :-

Environmental factor :- There are three environmental factors, that have an important role to play in world economic development

1) **Climate :-** Climate has both direct and indirect effects on economic development. One obvious climatic factor directly affecting conditions of production is, in general, the extremes of heat and humidity. In most poor countries, it contributes to deteriorating soil qualities and the rapid depreciation

of many natural goods. For most poor countries, it also contributes to low productivity of certain crops, the weakened regenerative growth of forests and the poor health of animals.

Extreme climatic condition in polar regions and mid-latitude continental deserts have been responsible for the backwardness of these regions.

ii) Resource Endowment :-

The World's resources are very unevenly distributed accounting for differences in economic development. With the exception of some middle-eastern countries, the developing countries, particularly in Asia, are not blessed with abundant supply of petroleum, coal and other natural resources. Parts of Latin America and Africa are very rich in resources, but in the absence of heavy investment, these resources have been unexploited.

Energy resources have a greater role to play in economic development, as there is a very close relationship between the available supply of energy and the stage and rate of economic progress.

(iii) The fragility of the Environment :

The fragility of the environment poses the most formidable obstacle to the economic process. Some of our present activities in the absence of control, may lead to a world that will be uninhabitable for the future generations. Topsoil is being lost because of over cultivation, improper cultivation, improper irrigation, ploughed grassland and deforestation. Water tables are falling because of over exploitation and heavy rates of withdrawal. Accumulated pollutants in the atmosphere – CO_2, methane, nitrous oxide, SO_2 and CFCs are enhancing the greenhouse effect causing global temperature rise. All of these will adversely will affect the productivity of agriculture, human health

and environmental quality, of particularly the poor Asian, African and Latin American countries. The degradation of their environment is affecting and will affect their development.

Historical factors:

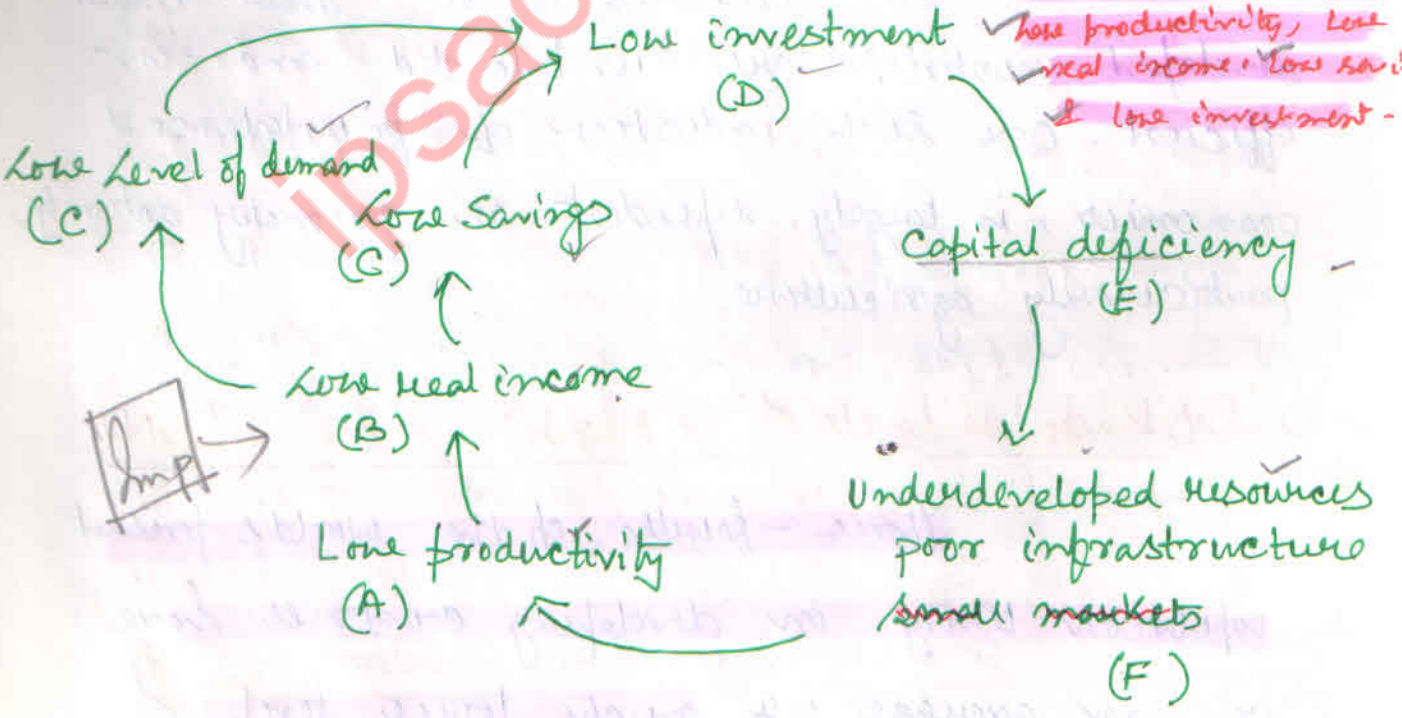
Many of the characteristics of under development found in Asian, African and Latin American countries are the product of being under colonial rule for a long period, which had a strong exploitative element. Even now colonialism is very much evident in the form of 'neo colonialism' which emphasise on control of country's economy from outside either from throug market or political control. Similarly, the political instability of countries like Pakistan, Nigeria, Zaire, Rwanda, Burundi has its roots in the imposition of political boundaries during the period of colonial control.

Economic factor :-

There are various impediments in the economic development of developing countries, which can be described under following points —

i) Vicious Circle :-

(a) Capital Shortage :- Shortage of capital is a major impediment in the establishment of industry, agricultural improvement, transport system development, technological input and research and development. Capital is in serious shortage in many developing countries, which contributes to the vicious cycle of poor infra, underdeveloped resources, low productivity, low real income, low saving & low investment.



(b) Small size of domestic market :-

The size of the domestic market in developing countries is not large enough

to sustain industrial growth because the purchasing power of consumer is too low.

(c) Poor infrastructure :- The infrastructure of most developing countries is poorly developed. Power supplies, transport facilities, industrial and commercial services, financial facilities – all of these which form the framework of economic activity need to be developed.

(d) Unbalanced and Inefficient Economies :-

The economies of the most under-developed countries are unbalanced and in-efficient. One such indication of unbalanced economies, is largely dependent on primary activity, particularly agriculture.

ii) Relatively low levels of per capita income & GNP

Three-fourths of the world's present population living in developing countries have, on an average, a much lower level of real per capita income.

iii) The growth stimulus of international trade :-

Developing countries, without oil or highly skilled workers, face formidable difficulties in generating rapid economic growth on the basis of world trade. Since the World War I, many developing countries have experienced a deteriorating trade position. Their exports have expanded but not as ~~fast~~ ~~first~~ fast as the exports of developed nations and their terms of trade have declined steadily. Moreover, developed countries through their advanced science and technology, remain more competitive, develop more new products and obtain international finance on much better terms.

Lastly, developed countries have typically resorted to various forms of tariff and non-tariff barriers to trade, including import quotas, human rights etc.

iv) Stability & flexibility of political & social institutions :-

Well before the industrial revolution, the developed countries were independent consolidated nation-states, able to pursue national

policies on the basis of a general consensus of popular opinions and attitudes towards modernisation. In contrast many developing countries of today have only recently gained their political independence and have yet to become consolidated nation state with nationalism, scientific thought, social and economic mobility, the work ethic and dedication to national, material and cultural values.

Social and Demographic Factors

The human factor has historically played a very important role in the economic development of many countries. Capital for infrastructure development can atleast be borrowed, but human attitude, skill, willingness must come from inside.

5) Quality of Population :-

The ability of a country to exploit natural resources effectively is dependent on, among other things, the managerial & technical skills of its populat...

The pop in the less developed countries are, on the whole, less educated, less experienced and less skilled than their counterparts in the early periods of economic growth. The quality of pop continues to hinder the economic development of many countries. In health, illiteracy affects a vast number of popln and contributes to the circle of poverty.

ii) Rapid growth of popln :-

The rapidly growing popln creates a serious problem because people have to be fed, housed, clothed and are to be provided with jobs from capital resources which are in short supply or which would be better invested for future growth. In any country where popln increase is greater than economic growth, the standard of living are inevitably falling.

iii) Problems of land tenure :- Problems of land tenure are major obstacles to agricultural development. If most land is in the hands of few land lords who levy high rent and give little security of tenure, the farmer's encentive for agricultural development is reduced, reducing the productivity.

iv) Social customs Social customs also hinder change. The joint family system where the authority is in the hands of a few elders leads to respect for traditional methods, restricts individual enterprise and makes innovation difficult.

v) Convention or Taboo :-

Resources use is hampered by convention or taboo. For e.g., in Africa, the value of cattle as a sign of social distinction has led to overstocking of low quality animals.

Scientific & Technological factors:

In important areas of scientific & technological research, contemporary developing countries are in extremely disadvantageous position vis-a-vis the developed countries. When the developed countries were embarking on their early growth process, they were scientifically and technologically greatly in advance of the rest of the world. Developed They have thus focussed their attention on staying ahead by designing and developing new technology at a pace dictated by their long term economic growth requirement.

INDICATORS OF DEVELOPMENT :-

HDI & GNH :- Already discussed.

i) **GDI :-** (Gender Related Development Index)

GDI is an index designed to measure gender equality.

GDI, together with Gender Empowerment Measure (GEM) were introduced in 1995 in HDR written by the United Nations Development Programme. The aim of these measurements was to add a gender-sensitive dimension to the Human Development Index (HDI).

The GDI is often considered a "gender-sensitive extension of the HDI" (Klasen). It addresses the gender gaps in life-expectancy, education & incomes.

The GDI can not be used independently from the HDI score, and so it can not be used on its own as an indicator of gender-gaps. Only the gap between the HDI and the GDI can be accurately considered; the GDI on its own is not an independent measure of gender gaps.

Gender Empowerment Measure (GEM) is an index designed to measure gender equality

GEM is the UNDP's attempt to measure the extent of Gender inequality across the globe's countries, based on women's relative economic income, participation in high-paying positions with economic power and access to professional and parliamentary positions. It was introduced at the same time as the GDI but measures topics like empowerment that are not covered by that index.

The GEM was designed to measure "whether women and men are able to actively participate in economic and political life and take part in decision making." The GEM tends to be more agency focussed (what people are actually able to do) than well being focussed (how people feel or fare in the grand scheme of things). The GEM is determined by - i) proportion of seats held by women in national parliaments ii) percentage of women in economic decision making positions (administrative, managerial, professional, technical) iii) female share of income (earned incomes of males vs females).

GEM is thought to be a variable policy instrument to compare gender equality between different countries.

Gender Inequality Index (GII) is an index of measuring gender disparity, included in the 2010 HDR. According to UNDP, this index is a composite measure which captures the loss of achievement within a country due to gender inequality. It uses three dimensions:—

i) Reproductive Health:- The GII's dimension of reproductive health have two indicators —

a) Maternal Mortality Ratio (MMR):- data for which come from UNICEF's State of the World's children ~~and~~ (b) the adolescent fertility Rate (AFR):- data for which come from UN Department of Economic and Social Affairs.

ii) Empowerment: The empowerment dimension is measured by two indicators

a) the share of parliamentary seats held by each sex, obtained from the International Parliamentary Union.

b) Higher education attainment levels: which is obtained through United Nations Educational Scientific and Cultural Organization (UNESCO) and Barro-Lee data sets.

iii) Labour market participation: The labor market dimension is measured by women's participation in the workforce. The dimension accounts for paid work, unpaid work, and actively looking for work. The data for this dimension is obtained through the International Labor Organization databases.

Global Progress Indicator (GPI) is a metric that has been suggested to replace, or supplement, gross domestic product (GDP). as a measure of economic growth. GPI is used in green economics, sustainable and more inclusive type of economies by factoring in environmental and carbon footprints that business produce or eliminate. "Among the indicators factored into GPI are resource depletion, pollution, and long term environmental damage.

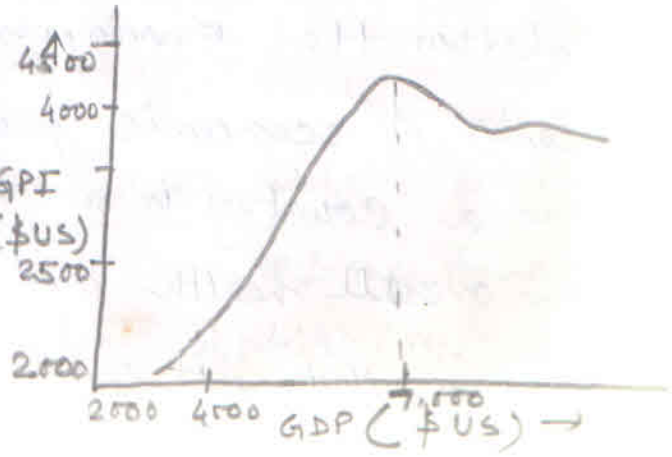
GPI is an attempt to measure whether the environmental impact and social costs of economic production and consumption in a country is a negative or positive factor in overall health and well being. GPI advocates claim that, it can more reliably measure

economic progress, as it distinguishes between the overall "shift in the value basis of a product, adding its ecological impacts into the equation."-

The need of GPI was highlighted by Marilyn Waring in 1980s and became popular among the advocates of green economics & Neo-classical economics.

Herman Daly, John B. Cobb, Philip Lawn have asserted that a country's growth, increased good production and expanding services have both "cost" & "benefits". They assert that, in some situations expanded production facilities damage the health, culture & welfare of the people. Growth that was in excess of 'sustainable norms' had to be considered to be uneconomic.

According to the 'threshold hypothesis' developed by Manfred Max-Neef, the notion that "when macroeconomic system expand beyond a certain the additional



benefit of growth are exceeded by the attendant costs"

Calculation of GPI can be presented in a simplified form :- $GPI = A + B - C - D + I$

A is income weighted private consumption

B is value of non-market services generating welfare

C is private defensive of natural deterioration

D is cost of deterioration of nature and natural resources

I is the increase in capital stock and balance of international trade.

Note :- GPI indicator is based on the concept of Sustainable income, presented by economist John Hicks (1948).

Sustainable income is the amount a person or an economy can consume during one period without decreasing his or her consumption during the next period.

Index of Sustainable Economic Welfare (ISEW)

is an economic indicator developed by Daly & Cobb, intended to replace the GDP, which is the main macroeconomic indicator of System of National Accounts (SNA). Rather than simply adding together all expenditures like the gross domestic product, consumer expenditure is balanced by such factors as income distribution and cost associated with pollution and other unsustainable costs. It is similar to the GPI (Global Progressive Index)

ISEW is roughly defined by the following formula.

ISEW = Personal consumption +
Public non-defensive expenditures
− private defensive expenditures
+ capital formation
+ services from domestic labor
− costs of environmental degradation
− depreciation of natural capital.

Happy Planet Index: (HPI) is an index of human well-being and environmental impact, introduced by the New Economics Foundation (NEF) in 2006. It measures the environmental efficiency with which human well-being is achieved within a given country or group. Human well-being is defined in terms of subjective life satisfaction and life expectancy while environmental impact is defined by the ecological footprint.

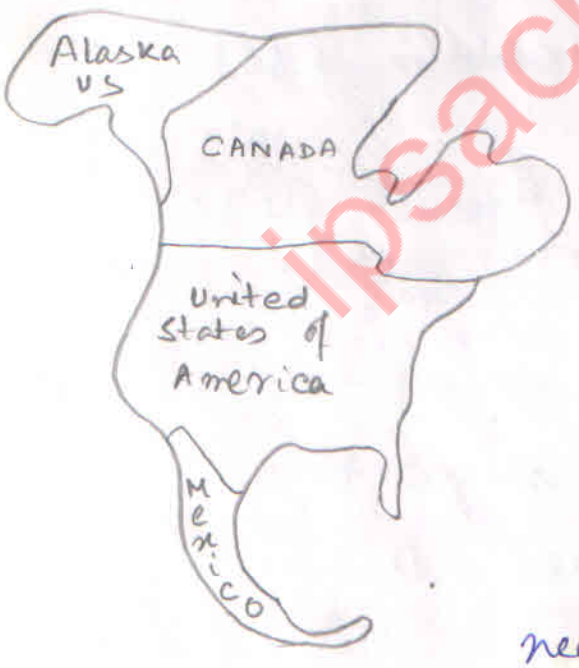
Pattern of Economic Development & Disparity across the World (UPSC-2001)

The economic disparity across the World can be studied, by dividing the globe into geo-politico-economic regions :-

Developed regions :-

1) The Anglo-America or North America

Anglo America includes USA & Canada, while North America includes Mexico also.

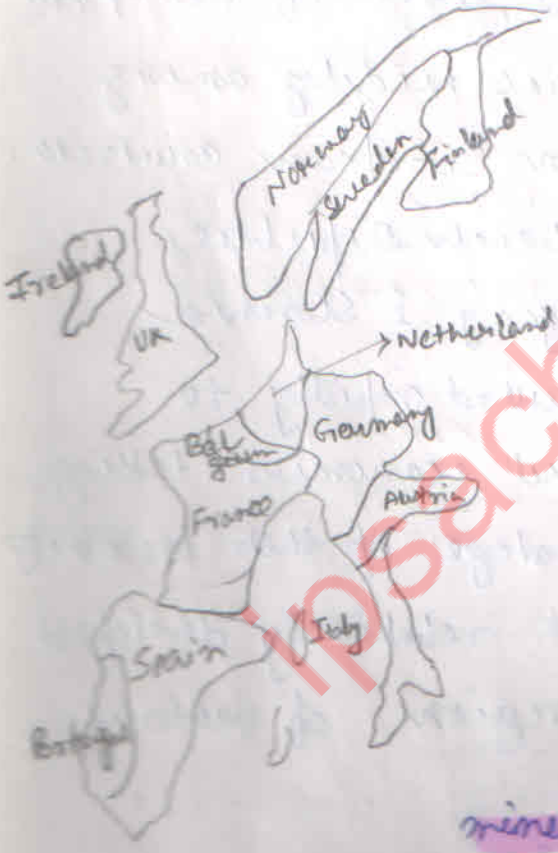


USA & Canada rank among the World's most developed countries on the basis of various economic, social and demographic characteristics. The region has highest per capita GDP and is well endowed with most minerals needed for industry.

Although fewer than 5% of the region's workers are engaged in agriculture, Anglo-America is the world's most important food [illegible]. On the other hand, the region ha

the world's highest percentage of tertiary sector (service) employees. Anglo-America is the leading provider of processing services, media, computer analysis and information monitoring.

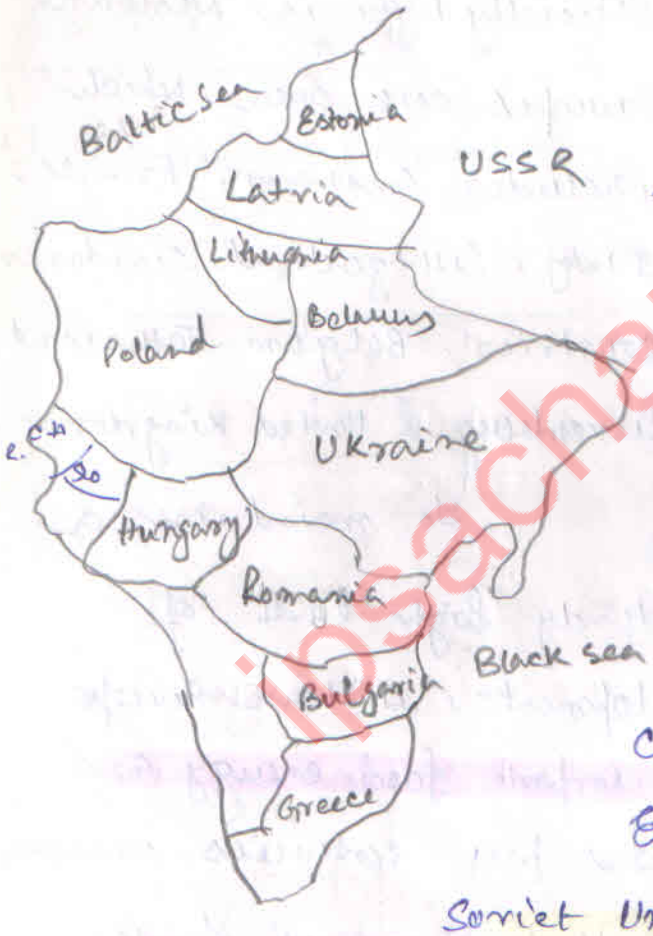
2) Western Europe :-



The level of development is especially high in Western Europe's core area, which includes Germany, France, Italy, Switzerland, Scandanavian countries, Belgium, Netherland, Luxemberg & United Kingdom.

To maintain a relatively high level of development, Western Europe must import food, energy and minerals. In fact centuries, western Europeans explored and mapped the rest of the world and established colonies on every continent. These colonies supplied many resources needed to foster European economic development.

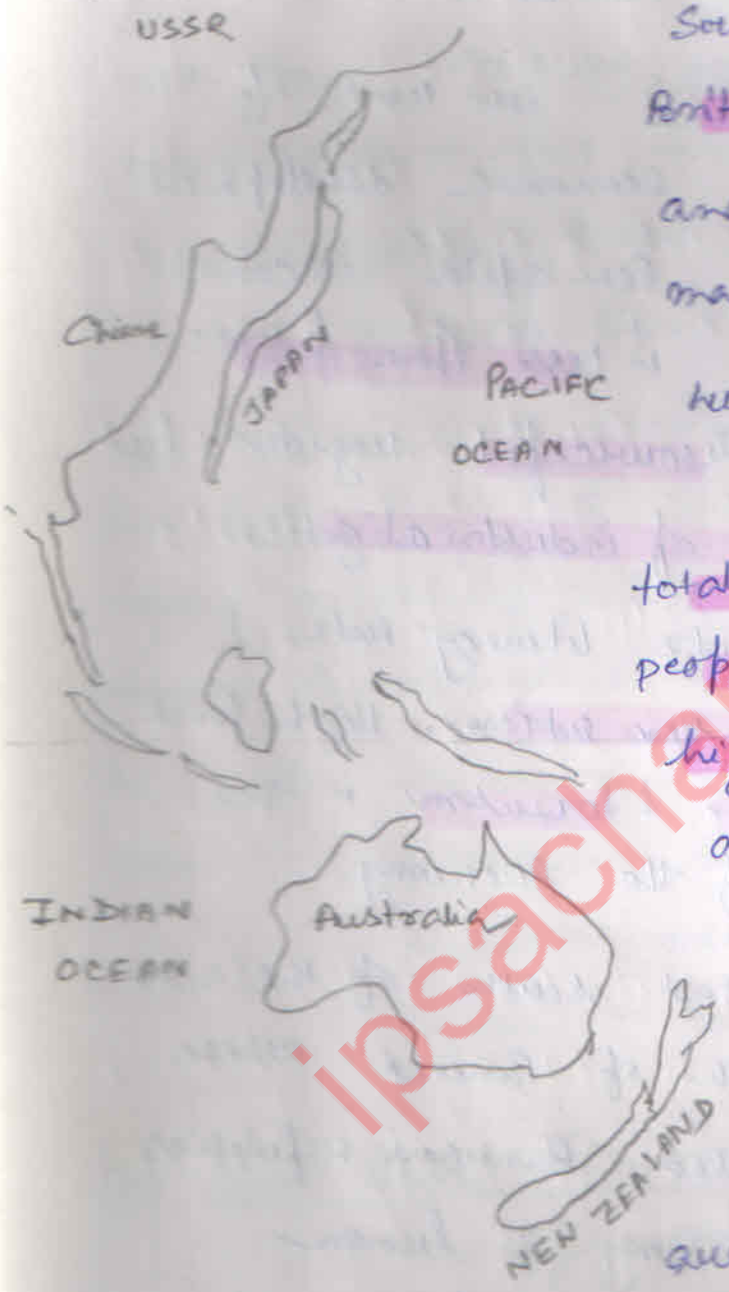
Eastern Europe: Between the late 1940s and late 1980s communist-dominated countries were Eastern European countries and influenced by erstwhile Soviet Union. (and eight small countries — Albania, Bulgaria, erstwhile CzechoSlovakia, East Germany, Hungary, Poland, Romania & Yugoslavia)*



The level of development varies widely among Eastern European countries. The Czech Republic, Hungary & Slovenia converted rapidly to market economies, taking advantage of their proximity to the relatively developed core region of western Europe.

Soviet Union & Yugoslavia fragmented in part because republics such as Russia and Slovakia preferred more rapid economic change than Belarus & Serbia. These are mainly quasi developed ago-industrial economies with high or economic and development index.

4) South Pacific & Japan:



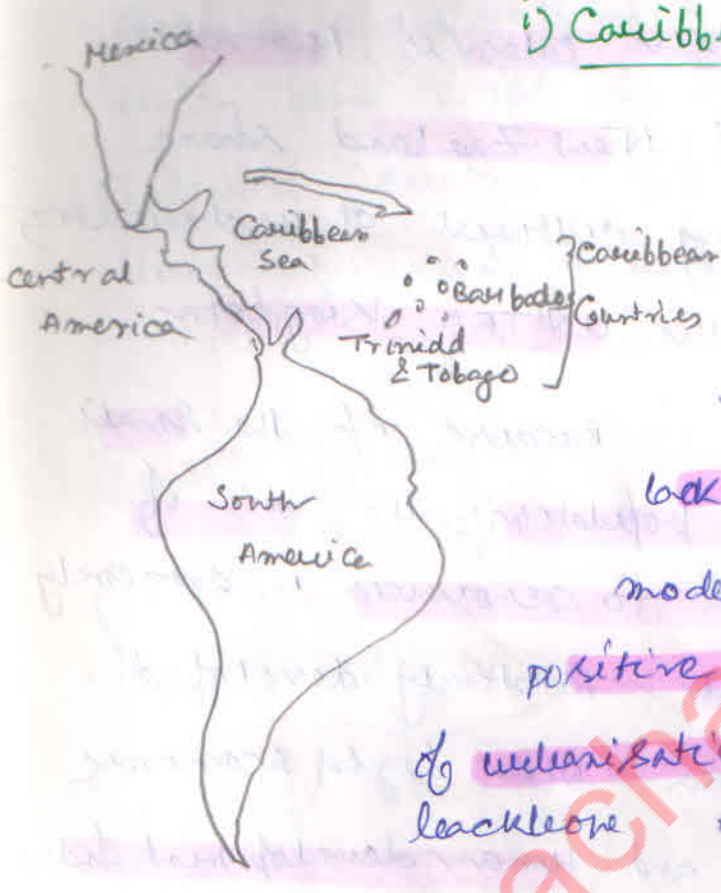
South Pacific, as former British colonies, Australia and New Zealand share many cultural characteristics with UNITED Kingdom.

Because of the small total population, the ratio of people to resources is extremely high. Relatively developed area with high economic and human development Index. Australia & New zealand are net exporters of food and other resources and are closely tied economically to Western Europe, Japan & Anglo America.

The level of development in Japan, contrast sharply with other large Asian countries. Japan ranks among the World's most productive states. Japan's development is specially remarkable because it has an extremely unfavourable ratio of population to resources with most intensively farmed land & one of the highest physiological densities.

Less Developed Regions

① **Latin America**. It has 3 Subunits :-



i) **Caribbeans** :- Low level of economic development. Per capita income is less than $5000. Resourceful region, but lack of industrialization, moderate literacy rate & positive sex ratio. High level of urbanisation & tourism is the backbone of the economy.

ii) **Central America** :- Located south of the river Rio-grande and north of Panama. These countries are also called Banana Republics. Both the economy & human development lag behind the rest of the continent. Poorly developed economies, low per capita income (except Mexico), low level of literacy, urbanisation are the main characteristics of this region.

iii) South America: Countries like Chillie, Argentina has highly developed economies. But Brazil, Uruguay are quasi developed. They are mineral rich or raw material rich but lacks industrialigation. Brazil has high land-man ratio. Countries like Columbia, Bolivia, Guyana are economically backward. Overall, South America has high level of urbanisation, rich in natural resources and quasi-developed economies. Human development is better than the rest of the Latin America. But, cast systems are still there:

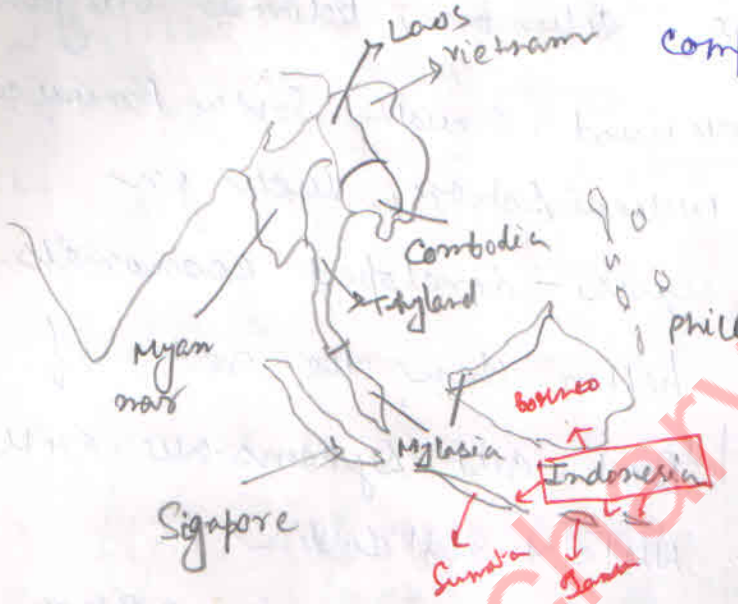
Mestizo — White + red Indian
Mulato — middle class — White + Black
Zambo — Black + Red Indians

(c) East Asia (China)

Transformation of China's economy towards capitalism was the indication of China's journey towards economic development. Cheaply available man power, mixed with investment friendly govt policies are drawing foreign companies in search of benefits and thereby bringing FDI. Availability of abundant rare earth material in china (Mongolia) has paved the way

for the electronic industry. Human development is poor specially in the land-locked north-western region.

(3) South east Asia :- The south east Asia region comprises of eleven countries. Five are entirely on Asian main land —



Cambodia, Laos, Myanmar, Thailand and Vietnam. The six others are scattered across thousands of islands in the Indian and pacific oceans. Most islands are the part of Indonesia or the Philippines.

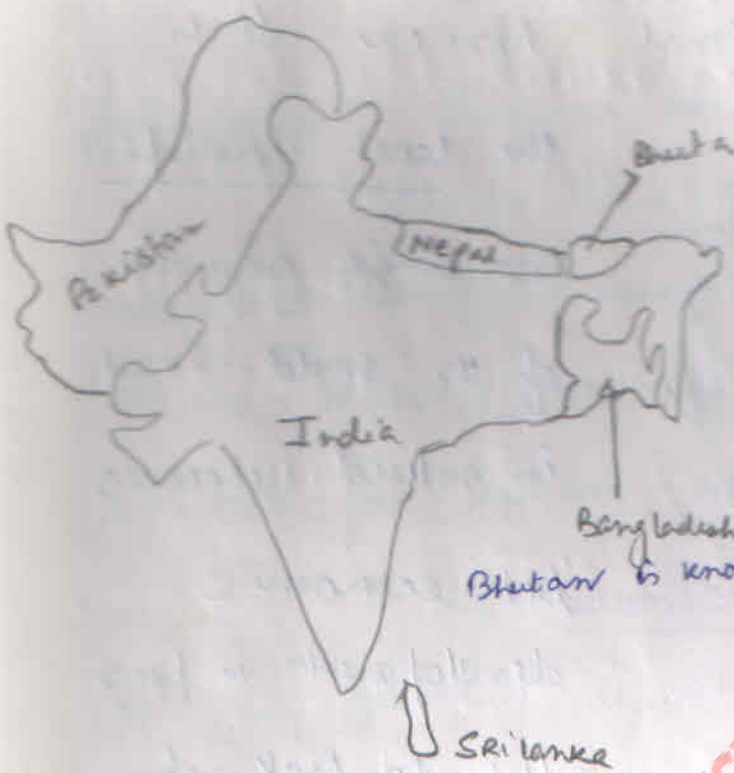
Because of distinctive vegetation & climate, famous in S-E Asia concentrate on harvesting products that are used for manufacturing. The region produces a large percentage of the World's supply of palm

oil and copra (coconut oil), natural rubber, kapak, abaca (natural fibers). due to rapid increase in popln, Myanmar, Cambodia & Laos. still continue to remain in vicious circle of underdevelopment with poor human development. While, Thailand, Vietnam, Philippines, Malaysia and Indonesia have shown remarkable improvement. Vietnam recently has counted among the one of the fastest growing economies of the world. Malaysia, Philippines and Thailand and smaller island countries have attracted tourists from all over the world.

④ The Middle East :- Middle east or west Asia is called the cross-road of the world. Region has always remain a zone of conflict for petroleum. Region has high economic development with high per capita income in Kuwait, UAE, Saudi Arabia, Iran and Iraq. Syria and Jordon

are the poorest country. Human development is very poor, with restrictive role of women in society, business, economy & political sphere. Education, science, democratic rights, natural justice system are not developed. Thus, though, economic development is high, human development is very much lagging.

(5) South Asia: The region includes India, Pakistan, Bangladesh, Srilanka and the small Himalayan states of Nepal and Bhutan. Agriculture is carried out in many region in subsistence method, depending on climate. Agricultural output declines sharply in case of poor monsoonal rain. Countries like Pakistan, Nepal & Bangladesh



have very limited resource base, which hinders economic development. On the other hand high population density and land man ratio hampers economic development. India, one of the fastest growing economies of the world still lags in some areas of human development such as MMR, IMR, child marriage, dowry deaths etc.

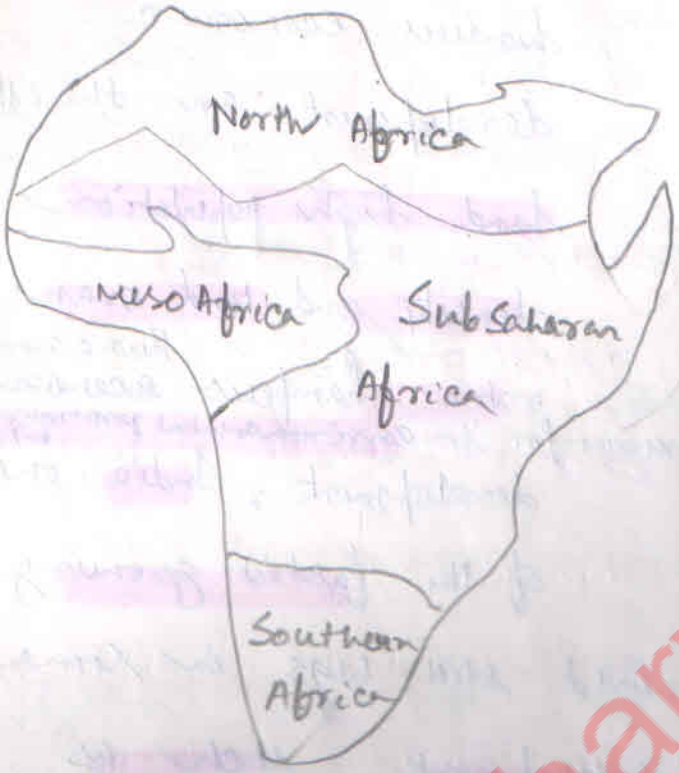
Bhutan is known for its environmental protection & happiness.

⑥ Africa: Can be divided into three regions—

i) Saharan and Sub Saharan Africa:

These are desert countries with petro-dollar economy. Per capita income of the region is better than meso African countries. But the region lacks in human development, Poor condn of women in society, lack of scientic education, absence of judicial justice system, Liberty are prominent.

ii) Muso Africa:- It is also called central Africa. It is the least developed economic region of the world. Great in natural resources but economic development is poor due to lack of investment and infrastructure.



Human development is very poor with highest mortality rates in Sierra Leone, Guinea and in adjacent countries. Region is suffering from clash of civilization, ethnic strikes etc.

iii) Southern Africa:- Relative better developed than the rest of the African countries. It has great natural resources. South Africa is a quasi-developed economy. But the benefit of the developed economy have been enjoyed primarily by the minority of the country's people who happen to be white.

Resources

Definition: Resource are the natural endowment which have economic value or utalitarian value to satisfy human want. Resource refer to all the naturally occurring substances, which are utilised for human emancipation & welfare.

Prof. Zimmermann may be quoted, for his famous definition of resources, by saying that 'resource', "does not refer to a thing or a substance but to a function which a thing or substance may perform or to an operation in which it may take part."

A barrel of petroleum is a resource because it satisfies a set of human wants. Therefore, petroleum to a pre-historic man was not a resource nor is it any resource to Jarwa of Andaman Islands or to a ~~Pygmy~~ of the Equitorial rainforest. Petroleum is an element in nature and its interaction with man, depending on man's knowledge and ~~att~~ towards it, makes it a resource.

Resource is a cultural concept & mental construct as well. Our culture determine our economic behaviour and thus natural objects, which are resource for a community, is neutral stuff for others. For, e.g., cow is not a food resource in India, but elsewhere it is a food resource.

Resource is a technology based concept, with technology advancement the concept of resource changes, therefore resource itself is a dynamic concept. Meaning of resource has changed with time, as human has discovered more efficient technology.

According to Amartya Sen, every individual born on the Earth, has a natural right to posses as much resources as he requires for full development of his or her personality & economic well being. Thus resources needs to be redistributed, by the state. It is popularly known as entitlement theory of resources. The theory

is based on the highest ideals, but practical and pragmatic policies can not be in line with the entitlement theory.

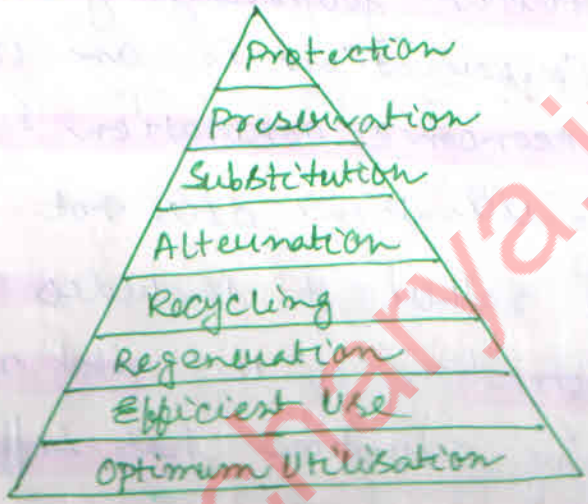
Resource Conservation & Management :

Conservation of resources means utilisation, without jeopardizing the supply in the future. Conservation is an inclusive term with both economic conotation & environmental conciousness. Conservation does not forbid economic use, rather it includes regeneration, preservation, protection of the vital resources, so that the coming generation has sufficient amount of resources left, for their economic well being.

Management, on the other hand means the optimisation and efficiency in utilisation of resource, to maximise the value or profit & minimise the cost of the losses. For e.g— water management means efficient & optimum utilisation of water, either by technology or by human efforts. While water conservation means protection of existing & finding new sources, recycling & economic utilisation. The two terms are not anti-thetical, rather

complementary to each other. Natural resource conservation includes the resource management.

Methods for resource conservation and conservation pyramid :-



1) Optimum utilisation : means using the resources to its minimum level, without compromising on output.

2) Efficiency :- means the maximisation of utilitarian value

3) Recycling : Rather than complete disposal & destruction, recycling has been suggested as one of the means of conservation of resources. For. eg - Scrap iron based steal industry.

4) Substitution :- Since the non-renewable resources are irretrievable, it is necessary to substitute their use by the renewable resources as far as possible. For e.g. hydroelectricity, whenever possible should be given preference to thermal electricity

5) Alteration :- Use of frequently available resources with judicious mix of scarce resources. For example – use of Bio-diesel by mixing it with petroleum.

6) Regeneration :- Production, excavation, research for discovering new sources of resources. For e.g- Reforestation.

7) Preservation :- Preserving the resources for future use and increasing their life span.

8) Protection :- protection involves non-utilisation for a period of time, so that resources can be either replenished by nature itself or they remain intact in the current level of existence.

The Functional theory of Resources :-

It is well known that functionability of a thing or a substance with relation to human wants makes it a resource. But skepticism arises as to what makes a thing functional to human needs.

According to C. Mitchell "incomparably greatest among human resource is knowledge. It is greatest because, it is the mother of other resources. Not only is knowledge is the greatest of resources, it is also the resource that we have counted upon to grow richer with every decade."

Any material or non-material thing, which is not functional to human need at individual, social or some higher levels, fails to qualify as resource. Functionality is therefore, basic to resources. Natural rubber used to be thought of as a doubtful material for making tyres & tubes which subsequently revolutionized the transport system, with the process of vulcanization and became -tionally related to man.

ENERGY CRISIS

Energy crisis does not ~~refer~~ only refer to the scarcity of energy resources, rather disequilibrium & imbalance in the demand & supply mechanism, which has more geo-political tangles, rather than natural crisis.

Energy crisis must not come through petroleum crisis alone, rather it must incorporate, the entire energy sector.

An 'energy crisis' is any great bottleneck (or price rise) in the supply of energy resources to an economy. In popular literature though, it often refers to one of the energy source used at a certain time and place, particularly those that supply national electricity grids or serve as fuel for vehicles.

A crisis can develop due to industrial like union organized strike and government embargoes. The cause be overconsumption, bottlenecks at oil refineries, pipeline failure, political ~~bottle~~ events, attack by terrorist or militia etc.

Historical Crises:

1973 oil crisis: In wake of Arab-Israel 'Yom Kippur War', OPEC Countries

raises the price of the oil by 5 times, thus the crisis was product of go-political gimmics.

1979 Crisis: The Islamic revolution in Iran and the falling export from West-Asia, increases the petroleum price to $33/barrel, which was finally settled at $23/barrel.

1991 Crisis: (Iraq War) The petroleum prices had risen to $56/barrel, as the petroleum ~~prices~~ supply further fell.

1997: Petroleum price fell to the lowest ever in the history of mankind to $10 barrel.
Because of - Oil for food programme in Iran
- South-East Asian economic crisis
- global warming & ~~rising~~ falling demand of petroleum in Europe & Anglo America.

2001, California Crisis: Demand of petroleum increases due to Silicon valley revolution and IT revolution, which is called California electricity crisis.

2007 :- The petroleum prices had ~~so~~ speculated to $150/barrel, in wake of demand from China (Olimpic games) and India. The price fell sharply to $60/barrel, as there was no such demand.

2015 :- petroleum prices fall rapidly till $35/barrel, due to increased production from OPEC countries and decreasing demand from USA (As USA started domestic shale gas production)

Causes of Energy Crisis:

It would be easy to point a finger at one practice or industry and lay the blame, for the entire energy crisis at their door. But that would be a very naive and unrealistic interpretation of the cause of the crises, as it has several dimensions:-

1) **Overconsumption:** The energy crises is a result of many different strains on our natural resources. There is a strain on fossil fuels such as oil, gas and coal due to overconsumption - which then in turn can put a strain on water and oxygen resources causing pollution.

2) Overpopulation :- Another cause is the steady increase in the World's population and its demand for fuel & products.

3) Poor Infrastructure :- Most of the energy producing firms keep on using outdated equipment that restricts the production of the energy.

4) Unexplored renewable energy options :- Still most of the energy comes from non-renewable sources like coal. Unless we give renewable energy a serious thought, the problem of energy crisis can not be solved.

5) Delay in Commissioning of Power Plants :- In few countries, there is significant delay in commissioning of new power plants. The result is that old plants come under huge stress to meet the daily demand of power. When supply doesn't matches demand, it results in load shedding & breakdown.

6) Wastage of Energy :- In most parts of world, people don't realize the importance of conserving energy. Simple things like switching off fans, light, where not in use, using maximum daylig-

walking instead of driving for short distances, using CFL, LEDs, proper insulation for leakage of energy can go a long way in saving energy.

7) Poor Distribution system: Frequent tripping and breakdown are result of a poor distribution system

8) Wars and Attacks: Wars between countries can also hamper supply of energy specially, if it happens in Middle-East countries like Saudi Arabia, Iraq, Iran, Kuwait, UAE and Qatar. That's what happened during 1990 Gulf war when price of oil reached its peak causing global shortages and created major problem for energy consumers.

9) Miscellaneous Factors:- Major accident like pipeline bursts, natural calamities, tax hikes, strikes, military coup, political events, severe climatic conditions, sudden increase in demand of energy, can cause a crisis situation.

Possible Solutions of the Energy Crisis :-

The solution for the energy crisis can be discussed under following heads —

1) **Move towards Renewable Resources :-** The best possible solution is to reduce the World's dependence on non-renewable resources and to improve overall conservation efforts. Much of the industrial outputs are created using fossil fuels, but there is also known technology that uses other types of renewable energies.

2) **Buy energy efficient products :-** Replace traditional bulbs, with instruments with LEDs, energy efficient instruments etc.

3) **Easier Grid Access :-** People who use different options to generate power, must be given permission to plug into the grid, and getting credit for power they feed into the greed. Apart from that subsidy on Solar panels should be given to encourage more people to explore renewable option.

4) **Energy Simulation :-** Energy Simulation Software can be used by big corporates to redesign building units and

reduce buisness energy cost. Most energy efficient buildings should be designed to reduce carbon footprints.

5) Perform Energy Audit: Energy audit is a process that helps to identify the areas where the organisation is losing energy and what steps should be taken to improve energy efficiency.

6) Common stand on Climate Change: Both developed and developing countries should adopt a common stand on climate change. They should focus on reducing greenhouse gas emissions through an effective cross border mechanism to reduce consequences of global warming and consumption of resources.

7) Alternate Sources of energy: Finding and use of alternate source of energy such as nuclear energy, shale gas, Sandtar, liquified coal, etc. Research & development for developing new energy efficient technologies.

8) Geo-political Solution:

a) intervention by United Nation's security Council.

b) Discussion in United Nation's general assembly

c) better bargain between OPEC & OECD

d) improve of bi-lateral relationship

e) Uninterrupted supply of petroleum without political bottlenecks.

f) Solution for west asian crisis, Syrian crisis etc.

There are many global initiatives that are working towards resolving the energy crisis. This has taken the form of increased regulation and restriction on carbon emissions, the promotion of greener manufacturing & construction projects, the funding of research into hybrid technologies and more sustainable technologies. Use of community knowledges and how community uses their local resources is important too. More Community gardens, parks and farmer's markets are springing up not only as a means of introducing more sustainable elements into society, but as an important part of educating the public about the importance of resources.

Factors influencing mining activities:-

1) **Physical influences on mining activity:-** Physical appearance or form of occurence of different minerals greatly affects their cost of extraction.

a) **depth:-** The relative ease of ~~influence~~ working is greatly influenced by the depth of the deposit. opencast working is cheaper than underground working. Generally speaking, igneous ores are more costly to mine than sedimentary ores due to their irregular form of occurrence.

b) **Quality:-** The quality or grade of ore is also an important consideration. Despite the high costs of iron mining in the harsh Arctic environment of Swedish Lapland and the great distance of this area from the main iron and steel producing centres of Western Europe, the Swedish mines at Kiruna are able to offer iron ore at a competitive price. This is largely due to the exceptionally high quality of the ore, which contains 55-70% iron.

c) **Size of resource:-** It is an extremely important consideration. Indeed there is a growing tendency for the size of

reserve to outweight all other factors. Ore deposits which offer possibilities for large scale methods of extraction, irrespective of the quality of the core, are increasingly being developed in many parts of the World. This trend has been described as 'the new philosophy of large scale, low-grade mining.'

Economic influences on Mining Activity:- Even if the physical characteristics of a given ore broadly make it suitable for potential working, a number of economic conditions must be fulfilled before exploitation takes place. The same condn will also determine the active life of any mine or quarry.

a) demand:- demand for a particular minerals is of course, the necessary stimulus for the initiation or continuation of working. Foreg., the growth of demand for copper during the present century has been largely due to its increasing use in electrical industry. Similarly the case of Bauxite in Aircraft inda

b) Capital :- The availability of capital is also essential for successful mining operation. The opening of a modern mine involves high levels of capital investment, in prospecting, surveying, the installation of mining gear, pumping equipment, ore-dressing plant and transport system. e.g. Due to unavailability of capital mining sector in Africa is still to explore its full potential.

c) Labour system : is another important factor. Mining is often carried out in remote areas of great physical hardship. For e.g - Arctic Canada, the great Australian desert and the high Andes. Not only is the local population sparse in such areas, but is also generally untrained for the highly technical and specialised work, which is characteristics of modern mining activity.

d) Transport : The availability of transport system to link areas of mining activity with their market is another essential condition. The railway of central Africa, as in many other parts of the world, can be explained largely in terms of the distribution of minerals and the need to link them with coastal transship-

c) technology: New assesments of the profitability of ore deposits must continually be made in the light of changes and improvements in the technology of mining, ore-dressing and metal smelting. For e.g. - Use of taconite, a very low-grade iron ore, found in the Lake Superior Highlands of USA, was started with the invention of Bessemer converter.

d) Political influence: Various political influences on of mining activity, has a vital importance on the development and functing of the activity. The possession of supplies of essential ores is of great strategic importance, especially in times of war. For e.g. during the 1st world war, Germany, cut off from its chilean source of nitrates, developed techniques from producing nitrates from atmospheric nitrogen, which in turn broke chile's virtual monopoly.

S.N. on Beneficiation :

In the mining industry beneficiation or beneficiation in extractive metallurgy, is any process which removes the gangue (commercially worthless) minerals from ore to produce a higher grade product (Concentrate) and a waste stream (tailings). Some beneficiation processes are froth flotation and gravity separation.

Beneficiation is probably the major hope of continuing production of many minerals. Rising prices will bring formerly uneconomic sources into production. Low-grade ores are increased in value by concentrating the ore at the source and shipping only high quality, beneficiated ores to processors.

Reading from Books :-

1. Water Resources - K.S. Chapter - 3
2. Forest Resources - K.S Chapter - 4
3. Biotic Resources - K.S Chapter - 5
4. Mineral Resources - K.S Chapter - 6
5. Marine Resources - K.S Chapter - 8

Some Definitions :-

Green Coke :- (raw coke) is the primary solid carbonization product from high boiling hydrocarbon fractions, obtained at temperatures below 630°C. It contains 4-15% by weight of matter that can be released as volatiles during subsequent heat treatment at temperatures up to approximately 1330°C.

Calcined Coke :- is a petroleum coke or coal-derived pitch coke obtained by heat treatment normally of green coke to about 1330°C. It will have ~~about~~ hydrogen content of less than 0.1% by weight.

Petroleum Coke :- is a black solid obtained mainly by cracking and carbonizing heavy hydrocarbon oils, tars and pitches. It consist mainly of carbon (90 to 95 %) and has low ash content. The two most important categories are "green coke" and "calcined coke".

Biogases :- Gases arising from the anaerobic fermentation of biomass and the gasification of solid biomass (including biom... waste.

The biogases from anaerobic fermentation are composed principally of methane & CO_2 & comprise landfill gas, sewage sludge gas and other biogases from anaerobic fermentation. Biogases can also be produced from thermal processes (by gasification or pyrolysis) of biomass and are mixtures containing hydrogen and carbon-monoxide (usually known as syngas) along with other components. These gases may be further processed to modify their composition and can be further processed to produce substitute natural gas.

Non Commercial Energy Sources :-

a) Fuel wood, wood residues & by products : Fuelwood or firewood obtained from natural or managed forests or isolated trees. Also

b) Charcoal : The solid residue from the carbonisation of wood or other vegetal matter through pyrolysis

c) Bagasse : The fuel obtained from the fiber, which remains after juice extraction in sugar cane processing.

Based on the availability in near future and replenishment, energy resources can be classified as —

Non-renewable resources, which when exhausted are exhausted forever.

Renewable resources, which can also be called inexhaustible.

Conventional: which has been in use by mankind for quite some time and which are more or less, direct form of energy

Non-conventional:- such as biogas, biomas in which one has to perform some processes before getting energy.

(*) Non-Utilitarian resources: value of these resources is social rather than practical. As western society has increased its standard of living, elements such as clean air and water or access to unspoiled recreation areas have become more valued. However the simultaneous demand of natural resources and non-utilitarian resources, can lead to conflicts, since the exploitation of the former destroys the later one. Thus, wilderness is replaced by farm or mine, while a basic conflict arises between the freedom to enjoy the non-utilitarian resources which is given by the use of motorcar, and often disastrous effects the car has on these resources [illegible]

Petroleum :-

Petroleum is also called 'black gold' or 'liquid gold'. It is second to coal in terms of sources of energy. It is an essential source of energy for all internal combustion engines in automobiles, railway & aircraft. Crude petroleum occurs in sedimentary rocks of the tertiary period. It is formed when large quantities of dead organisms, usually zooplankton and algae, are buried underneath sedimentary rock and subjected to intense heat and pressure. About 600 sedimentary basins, characterized by oil & gas occurrence, are found on Earth.

Unlike coal, petroleum is not distributed evenly around the world. More than half of the world's proven oil reserves are located in the Middle East. Following the middle East are Canada, & the US, Latin America, Africa & the region occupied by the former Soviet Union.

The two largest classes of fields are Super-giants, fields with 5 billion or more barrels of ultimately recoverable oil, and World-class giants, fields with 500 million to 5 billion barrels of ultimately recoverable oil. The two-thirds of these Super-giants are located at the Arabian-Iranian

sedimentary basin in the Persian Gulf. The remaining super-giants are distributed in USA, Russia, Mexico, Libya, Algeria, Venezuela & China.

USA - Mid continent Region - Northern Texas, Oklahoma, Kansas

Gulf coast - Southern Texas, Louisiana, Mississippi, Arkansas.

Rocky Mountain Area - Colorado, Montana, New mexico

Others - South California, Pennsylvania, Kentucky & Ohio.

Canada Prairie provinces, Alberta and Saskatchewan.

CIS - Baku, Volga, Urals region, eastern side of the caspian, Fergana valley, Sakhalin island.

Saudi Arabia Dhahran, Ghawar, Safaniya

Iran - Masjid-i-Sulaiman, Lali, Agha Jari, Feridoun

Iraq - Kirkuk, Zubair, Rumaila & Mosul

Kuwait - Burgan, Kuwait - Arabian Neutral zone

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UAE - Zakum, Abu Dhabi

Brazil – Lula, Sugar Loaf oil field

Mexico – Sabinas, Poza Rica,

Venezuela – Mene Grande & La Rosa, Bolivar Coastal field

Libya – Dahra, Beda, Zeltan

Nigeria – Biafra & other fields in Niger Delta

Others African fields – Angola, Gabon, Zaire, Chad, Niger, Ghana.

China – Daking, Shengli, Panlong, Yumen, Kashgar Shanderg.

Indonesia – Sumatra, Minas, Java

India – Assam, Gulf of Cambay, Bombay high

OPEC

More than 50% of the World's proven reserves are located in OPEC (organisation of the petroleum Exporting Countries) – Saudi Arabia, UAE, Venezuela, Algeria, Angola, Ecuador, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar.

Classification of Crude oil :-

Crude oil may be referred as sweet- if it contains relatively little sulfur (0.5%) or sour if it contains substantial amounts of sulfur. Sweet crude requires less energy to be

extracted & once extracted, yields higher quality gasoline. Iraq is one of the largest producer.

Sour crude, on the other hand, has a high level of impurities in it, namely sulfur, which must first to be removed before being processed into gas & other petroleum based products. Venezuela is a leading producer, others are gulf of mexico, Mexico, South America, Canada & OPEC, members are also relatively sour, with an avg. sulfur content of 1.77%

Limitations of Petroleum:

The whole world is too dependent on oil which is a non renewable resource.

- Petroleum is increasingly becoming expensive to mine and they are being used at a rapid pace.
- Oil burning leads to carbon emissions. It is one of the major source of air pollution
- Leakage of oil while drilling, oil transportation (by ship) can lead to spills, and accident causing marine pollution & loss of marine flora & fauna, as well as environmental & ecological damage.
- Oil recovery processes not efficient enough - still better technology needs to be developed to provide better yields
- Oil drilling endangers the environment & ecosystem.

Map

Natural Gas :-

Natural gas is a naturally occurring hydrocarbon gas mixture consisting primarily of methane, but commonly includes varying amounts of other higher alkanes & even a lesser percentage of carbon dioxide, nitrogen, and hydrogen sulfide. Natural gas is an energy source often used for heating, cooking and electricity generation. It is also used as fuel for vehicles and as a chemical feedstock in the manufacture of plastics & other commercially important organic chemicals.

Natural gas is found in deep underground rock formations or associated with other hydrocarbon reservoirs in coal beds and as methane clathrates. Petroleum is also found in proximity to and with natural gas. Most Natural gasses are created with two mechanisms -

1) Biogenic - Biogenic gas is created over time by methanogenic organisms in marshes, bogs, landfills & shallow sediments

c) Thermogenic :- Layers of buried plants, gases and animals ; deeper in the earth are exposed to intense heat and pressure over thousands of years, to form thermogenic natural gas.

Like petroleum, natural gas is not distributed evenly around the world. More than three-fourth of the World's proved natural gas resources are located in top ten countries. Following Russia are Iran & Qatar, Turkmenistan and USA. Small gas fields are located in various parts of the World. Unconventional sources of natural gas are —

- Shale gas
- Coal Bed methane (CBM)
- Methane hydrates.

Some of the largest gas fields are listed below —

South Pars/North dome - Persian gulf, Iran & Qatar

Urengoy - Siberian basin Russia

Yamburg - Arctic circle, Russia

South Iolotan - Osman - Turkmenistan

Hugoton - USA

Hassi R' Mel - Algeria

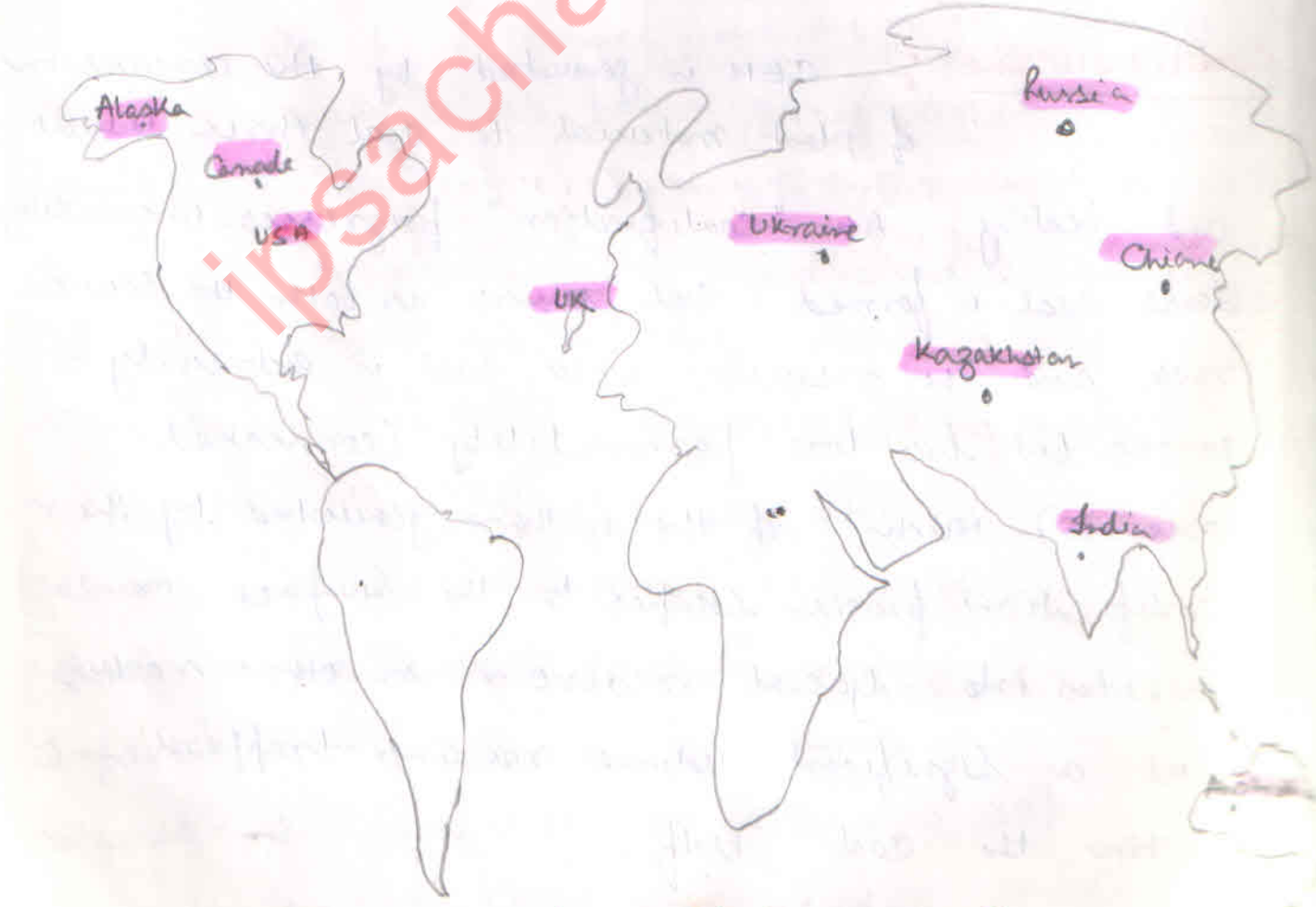
Medvezhye, Shtokman, - Russia

Shale gas: Shale gas is a natural gas produced from shale, a type of sedimentary rock. Since 2000, some countries, notably the US & Canada, have seen large increase in proved gas reserves due to development of shale gas, but shale gas deposits in most countries are yet to be added to reserve calculations. China is estimated to have the World's largest shale gas reserves followed by USA, Argentina, Mexico, South Africa, Australia & Canada.

The US & Canada are the major producers of commercially viable natural gas from shale formations in the world, even though about a dozen other countries have conducted exploratory test wells. Ukraine is the only nation outside North America, that has registered commercially viable production of shale gas, although the volumes contribute less than 1% of the total natural gas production for that country. In comparison, shale gas as a share of total natural gas production in 2012 was 39% in the US & 15% in Canada.

Coalbed Methane :- CBM is generated by the conversion of plant material to coal through burial and heating. As "coalification" progresses, increasingly dense coal is formed. Coal serves as both the source rock and the reservoir rock. Coal is extremely porous but has low permeability (connected openings). Much of the methane generated by the coalification process escapes to the surface or migrates into adjacent reservoir or other rocks, but a significant volume remains trapped within the coal itself.

CBM can be found almost anywhere there is coal. Deep coal seams beyond the reach of mining operations present opportunities for development of CBM. The largest proven recoverable CBM reserves, are in the USA, Russia, China, Australia, India and Indonesia. USA still dominates in the production of CBM. China and India is struggling in production of CBM production, due to more challenging geologic conditions and low well productivity.



Major Coalbed methane Reserves

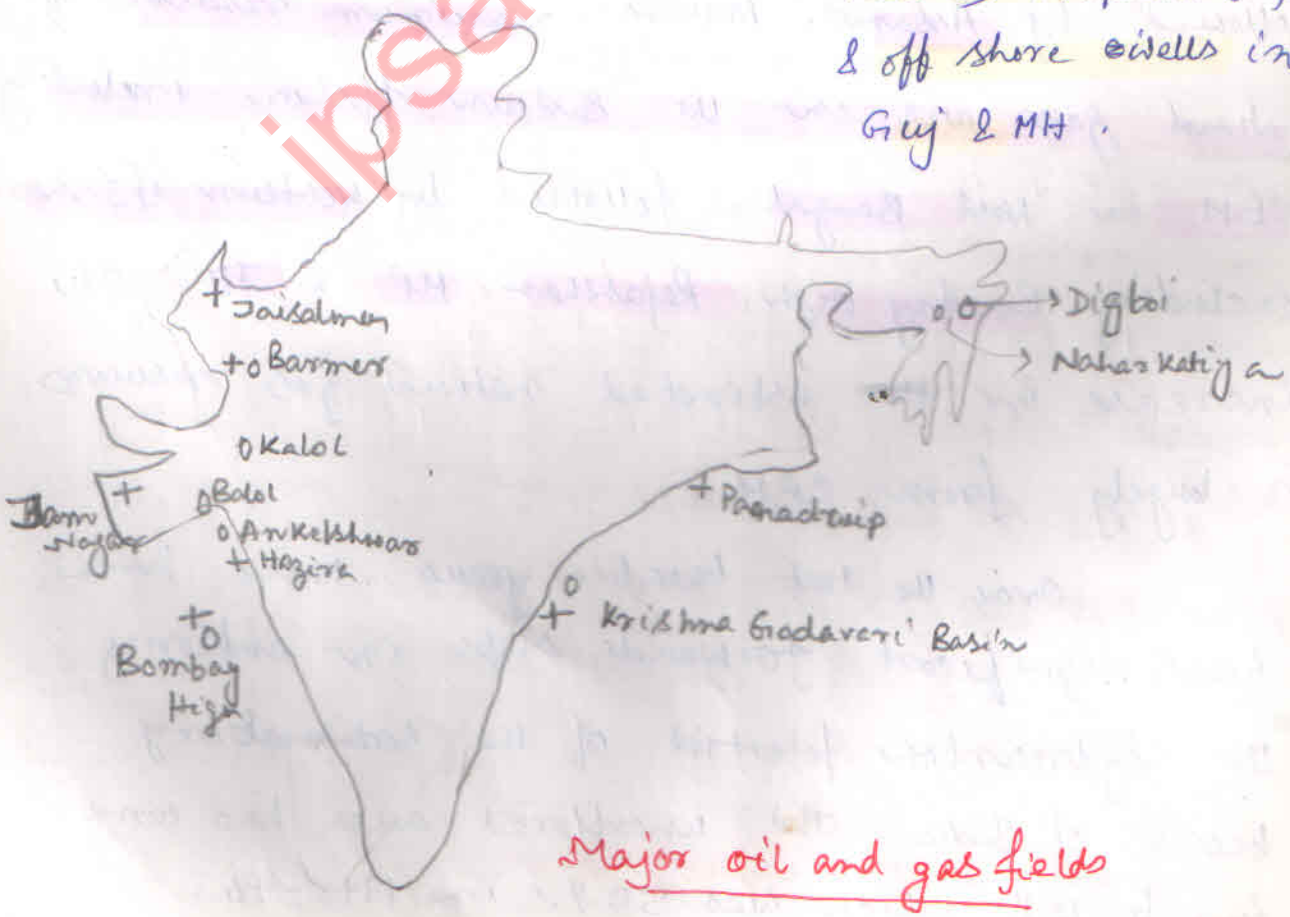
India - Petroleum & Natural gas

Oil exploration & production was systematically taken up after the Oil and Natural Gas Commission was set up in 1956. Till then Digboi in Assam was the only oil producing region. Mumbai High was discovered in 1973. In recent years, new oil deposits have been found at the extreme western and Eastern part of the country.

Geographical distribution of crude oil indicates that the maximum reserves are in the western offshore including Bombay High and Rajasthan (52%) followed by Assam. Whereas maximum reserves of natural gas are in the Eastern offshore including CBM in West Bengal, followed by western offshore including Bombay High, Rajasthan, HP & JH. The increase in the estimated natural gas reserves is largely from CBM.

Over the last twelve years, there have been significant forward steps in exploring the hydrocarbon potential of the sedimentary basins of India. The unexplored area has come down to 15% which was 50% in 1995-96.

oil & natural gas have been found in exploratory wells in Krishna-Godaveri and Kaveri basin on the east coast. Largest natural gas discovery has been made in Krishna-Godavari deep waters. Similarly largest oil discovery after Bombay High has been made in the Barmer oil fields of Rajasthan. In Assam, Digboi, Naharkatiya and Moran are important oil producers. The major oil fields of Gujrat are Ankaleshwar, ~~Kalol~~ Kalol, Mehsana, Nawagam, Kosamba, ~~Lunej~~ Lunej. Exclusive natural gas are located along the eastern coast as well as Tripura, Rajasthan & off shore wells in Guj & MH.



Major oil and gas fields

Coalbed Methane (CBM)

India has substantial coal reserves and most are suitable for CBM development. Deep coal deposits, not accessible by conventional mining operations, also offer CBM development opportunities. In 1997, India's govt formulated a CBM policy and alloted a number of blocks for exploration. First CBM production started in 2007 from Raniganj in WB. The CBM reserves as per Directorate General of Hydrocarbons are as under -

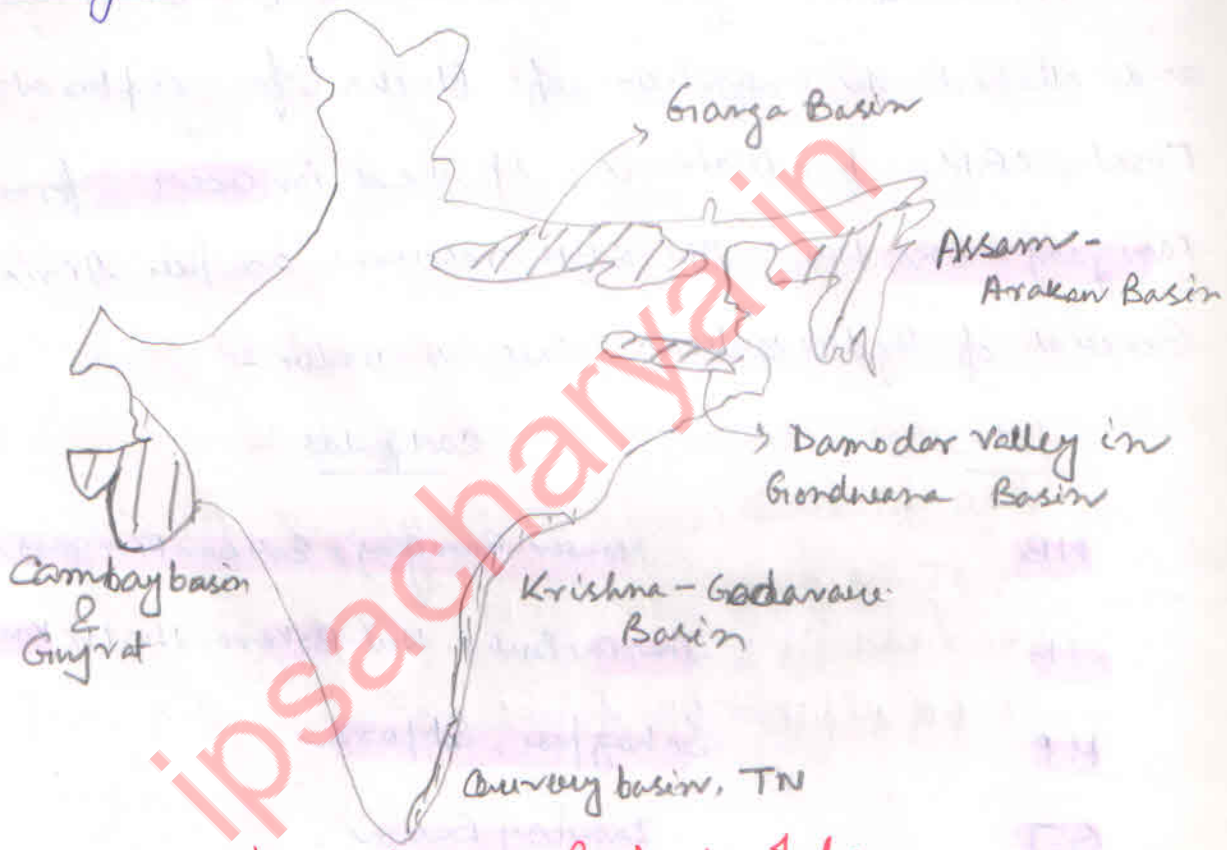
State	Coalfields
WB	North Raniganj, Eastern Raniganj, Birbhum
JH	Jharia, East & West Bokaro, North Karanpura
MP	Sohagpur, Satpura
GJ	Cambay Basin.

Shale gas

Shale gas has reduced America's dependence on oil imports, leading other countries to look for shale reserves. India too has potential to reduce its dependence on imports by tapping its potential of shale gas.

Six onshore basins — Cambay, Krishna-

- Godavari, Cauvery, Assam - Arakan, Ganga and Gondwana / Damodar - have been identified for shale exploration. The Indian govt entered into a MOU with the US Geological Survey (USGS) to conduct an assessment of the shale gas resources.



Shale - oil and gas Basin in India

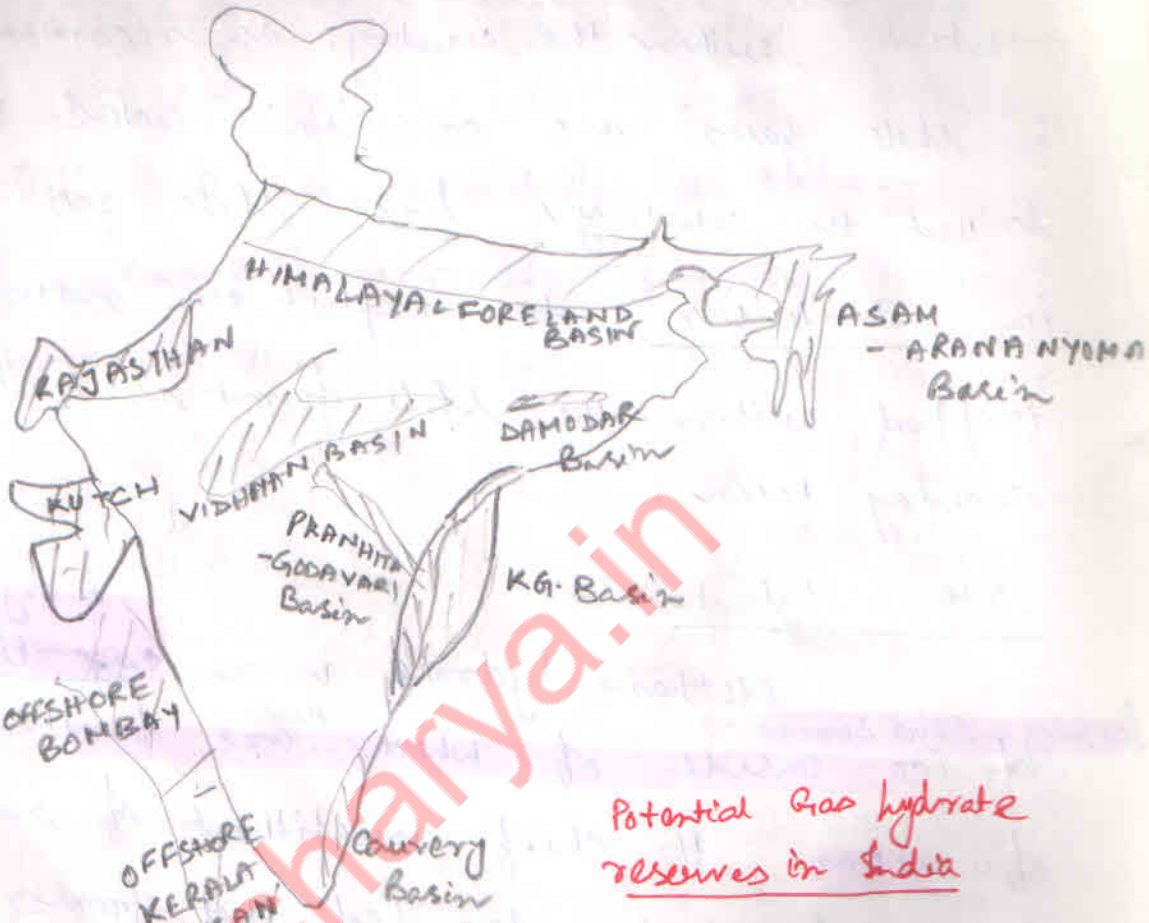
Krishna Godavari basin, located in Eastern India, is considered to hold the largest shale gas reserves in the country. The basin is estimated to have around 27 Tcf of technically recoverable gas. The cauvery basin in TN state is estimated to have recoverable shale gas reserves of 7 Tcf.

The Cambay basin of Gujrat has the largest potential within the country, as recoverable reserve of shale gases are concerned. ONGC had drilled the country's first shale gas well in Jambusar, to exploit the natural gas trapped within the shale formations located in cambay basin.

Methane Hydrate :-

Methane hydrate is a cage-like lattice or crystal structure of water forming a solid similar to ice inside of which, these are trapped molecules of methane, the chief constituent of natural gas. It is found in sea bed that forms at low temperatures and high pressure. It is also found in onshore deposits in the permafrost of northern canada & Russia. Heating the deposits or lowering the pressure will release gas from the solid. One litre of solid hydrate releases around 165 litres of gas.

India has some biggest methane hydrate reserves in the world. Four main areas are — Kerala-Konkan basin, the Krishna-Godavari basin, the Mahanadi basin, and the seas of Andaman Islands.



Potential Gas hydrate reserves in India

Merits of Natural Gas: i) Burn clean compare to other energy resources

ii) Toy. less CO_2 emission compared to other fossil fuels

iii) helps improve quality of air and water (not a pollutant)

iv) does not produce ashes after energy release

v) Has high heating value.

vi) Inexpensive compared to coal

Limitation: i) Natural gas is not a renewable source, it is a finite resource tapped in the earth.

ii) Inability to recover all in-place gas from a productible deposit because of unfavorable economics and lack of technology (It costs more to recover the remaining natural gas because of flow, access etc.)

Nuclear Energy

Nuclear energy has emerged as a viable source in recent times. Important minerals used for the generation of nuclear energy are uranium and thorium. Uranium is a relatively common element in the crust of the Earth. The main producers of Uranium are — Australia, Kazakhstan, Russia, Canada, Niger, South Africa, Brazil, USA.

Recycled uranium and plutonium is another source of uranium fuel. Re-enrichment of depleted uranium is another secondary source.

Thorium as 'nuclear fuel':

Today uranium is the only fuel supplied for nuclear reactors. However, thorium can also be utilized as a fuel for CANDU (Canada Deuterium Uranium) reactors or in reactors specially designed for this purpose. Neutron efficient reactors, such as CANDU, are capable of operating on a thorium fuel cycle, once they are started using a fissile material such as U-235 or PU-239. Then the thorium (Th-232) atom captures

a neutron in the reactor to become fissile uranium (U-233), which continues the reaction.

Th is about 3-5 times more common than Uranium. Present knowledge of the distribution of thorium resources is poor because of the relatively low-key exploration efforts arising out of insignificant demand. India & Australia are believed to posses 25% of the World's thorium reserves, each.

India: Andhra Pradesh followed by Jharkhand and Meghalaya in that order is top State with largest uranium reserves.

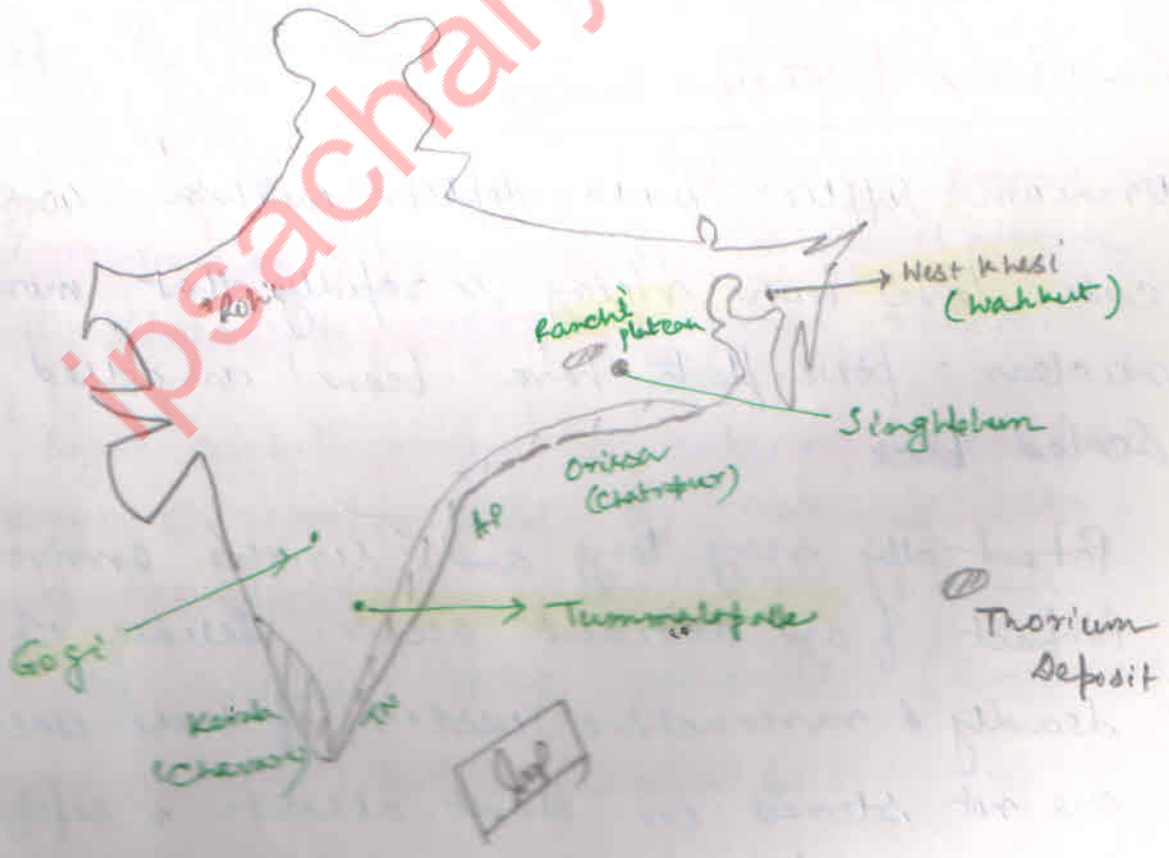
In 2013, India imported 40% of her Uranium requirements from France, Russia, Kazakhastan. Ministry of Environment and Forest rejected the proposal of Uranium mining in Meghalaya keeping in view of the sentiments of the local people and a number of representations received from local civil society group. Following are the uranium mines in Jharkhand's Singhbhum zone -

— Jadugude — Bhatin

- Tosamdih ✓
- Bagjata ✓
- Narwapahar
- Bandehurang ✓

Major areas which are currenty under Survey

1) Kadappa district - Tummalapalle (A.P)
2) Koppuru - Guntur dist (AP)
3) Rohil & adjoining areas (RJ)
4) West khasi hill Meghalaya
5) Gogi, Yadgir dist karnataka.



THORIUM

According to an estimate of DAE, India has the largest reserve of monazite ore, in beaches and rivers sands of the country. The States with large amount of thorium reserves are Odisha, AP, Kerala, TN, WB & Jharkhand. World's richest monazite deposits occur in Palakkad and Kollam districts of Kerala, near Visakhapatnam in AP, & Mahanadi river delta in odisha.

Limitation of Nuclear Energy:-

- Uranium supplies would deplete within 40-80 yrs
- Costs have been rising so rapidly that most nuclear power plants have been cancelled or scaled back.
- Potentially very long and serious environmental impact if an accident occur: Release of deadly & radioactive wastes, if these wastes are not stored in almost absolute & safety for thousands of years, can be very dangerous for human life.
- Require large amount of waters for cooling Power plants.

- cannot be used to power vehicles
- Fear of extracting plutonium for making deadly atomic bombs.

Benefits

1) It is relatively clean and climate friendly, compared to a coal-fueled power station. Even the waste it generates is compact, and considered 'strategic fuel & reserve' for the future

2) It has a better safety record than the fossil fuel

3) Huge amounts of energy is produced from small amounts of uranium. There is also a gradual shift to thorium based reactors

4) The high capital costs for nuclear power plant building is compensated by low fuel costs, ease of transportation etc. The overall cost of nuclear energy generation (electricity) is 50% to 80% that of other fuels.

But, Last 35 years we have witnessed so many popular movements against nuclear powers, based on the fear of possible

accidents, Countries like Germany, Spain, Belgium have phased out their nuclear programmes. The reactor blast at Chernobyl and the Three Mile Island meltdown continue to claim lives. No accurate assessment of their overall impact has been conclusively made.

Thus, the nuclear energy should be handled with utmost care and a vigilant management is necessary. The proper use of this resource can solve the problem of energy crisis in near future, which will be game changer for the development of mankind.

Coal

Of the three fossil fuels (Petroleum, natural gas and coal), coal has the most widely distributed reserves, coal is mined in over 100 countries, and all of continents except Antarctica. The largest proved reserves are found in the USA, Russia, China, Australia, and India. Coal is found majorly in forms of Lignite, anthracite and Bituminous; Pitt is the inferior variety.

Distribution of coal across the world, is as shown :-

In term of production, China is the top producer, other major producers are US, India, EU, Aus. Aus is the largest exporter, while Japan is the largest importer.

Major coalfields of the World

North America:

- Pensylvania anthracite field
- Appalachian bituminous field
- Eastern Illinois field – Illinois, Indiana, Kentucky
- Western field – Lowa, Missouri, Oklahoma
- Gulf province – Texas, Alabama, Arkansas
- Rocky mountain – Utah, Colorado
- Canada – Prairies, British Columbia

Europe:

- Donetz coal basin
- Moscow – Tula
- Kuznetsk
- Karaganda
- Silesia coal fields
- Ruhr, Germany
- Urals, Taimyr fields of Arctic

Asia :- China – Shanxi, Fushun, Inner Mongolia, Kansu

Japan – Chikugo, Ishikari

India – Damodar valley, Raniganj, Bokaro, Jharia, Singareni

Pakistan – Quetta, Kalabagh, Thar

Australia – Bowen Basin coalfield, Galilee Basin, South Maitland, Sydney Basin

Africa :- Transvaal and Natal, South Africa

Zimbabwe – Wankie

Zaire – Luena

Mozambique – Maniamba

Zambia – Nkandabwe & Hamba

Nigeria – Enugu

South America : Brazil – Santa Catarine, Riograndé di Sul

Chile – Concepcion

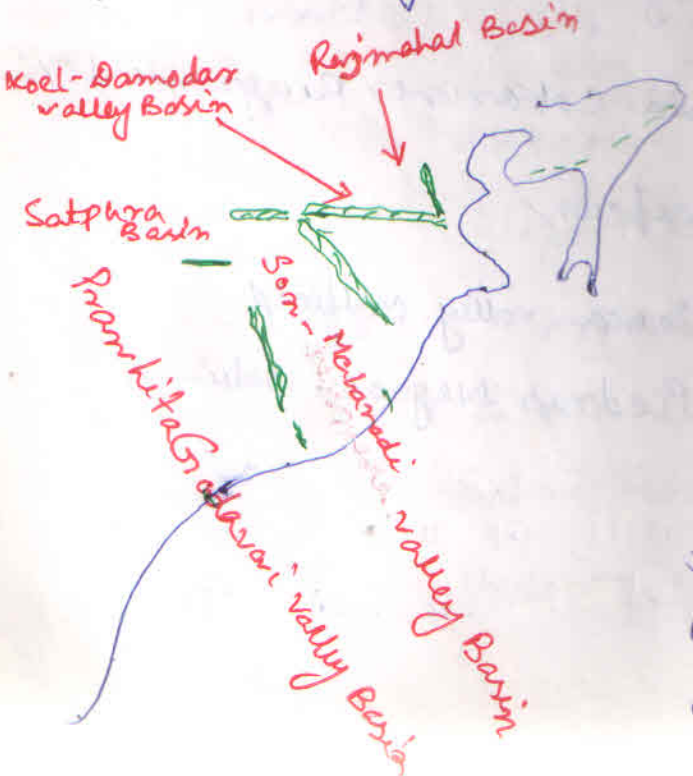
Columbia – Cauca valley coalfield

Mexico – Piedras Negras, Saltinas

Coal in India: Coal is the most important and abundant fossil fuel in India. It accounts for 55% of the country's energy need. Hard coal deposit mainly confined to eastern and south-central parts of the Country.

The lignite (mainly tertiary) resources mainly found in TN. Other states, where lignite deposits have been located are Rajasthan, GJ, Kerala, J&K, & Puducherry.

The Bituminus coal resources of India are available in older Gondwana formation of peninsular India and younger tertiary formation of N-E region.



Gondwana basins of Peninsular India

Gondwana basins of Peninsular India disposed in four linear belts following several prominent lineaments in the Pre-Cambrian craton.

In the extra-peninsular region (Darjeeling and Arunachal Pradesh), lower Gondwana sediments occur as thrust sheets overriding Siwalik sediments.

Gondwana Coal

Occurrence	Eastern & central part of peninsular India
Rank	Bituminous to Sub-bituminous
Character	Moderate to high in ash and low in Sulphur

Tertiary Coal

Occurrence	Northeastern India
Rank	Meta and Ortholignitous
Character	High in Sulphur; Strongly caking to non-caking

Lignite

Occurrence	Western & Southern India
Character	High in moisture & volatile matter

Deposit - Neyveli of TN (largest deposit), Barjeeling, Arunachal

Gondwana Coal

Coal bearing Strata

Raniganj / Kamthi Formation (Late permian)

- economically exploitable in Raniganj, Jharia, Eastern part of Singrauli basin and Godavari

Barakar Formation :- (Early permian)

Major store house of coal

Karharbari Formation :- (Early permian)

Restricted to few coalfields of Eastern India.

Major areas — Damodar, Mahanadi, Godavari and Narmada valleys. Raniganj, Jharia, Bokaro, Ramgarh, Giridih, Chandrapur, Karanpura, Tatapani, Talcher, Hingir, Hingiri, Korba, Penchgati, Sarguja, Kamthi, Wardha valley, Singreni (A.P) & Singrauli. The Jharguda Coal mine (Chhattisgarh) is the thickest Coal seam.

Tertiary Coal

- Found in the rocks of tertiary era, about 15 to 60 million years old
- also known as brown coal.
- 2% of total coal production of country.

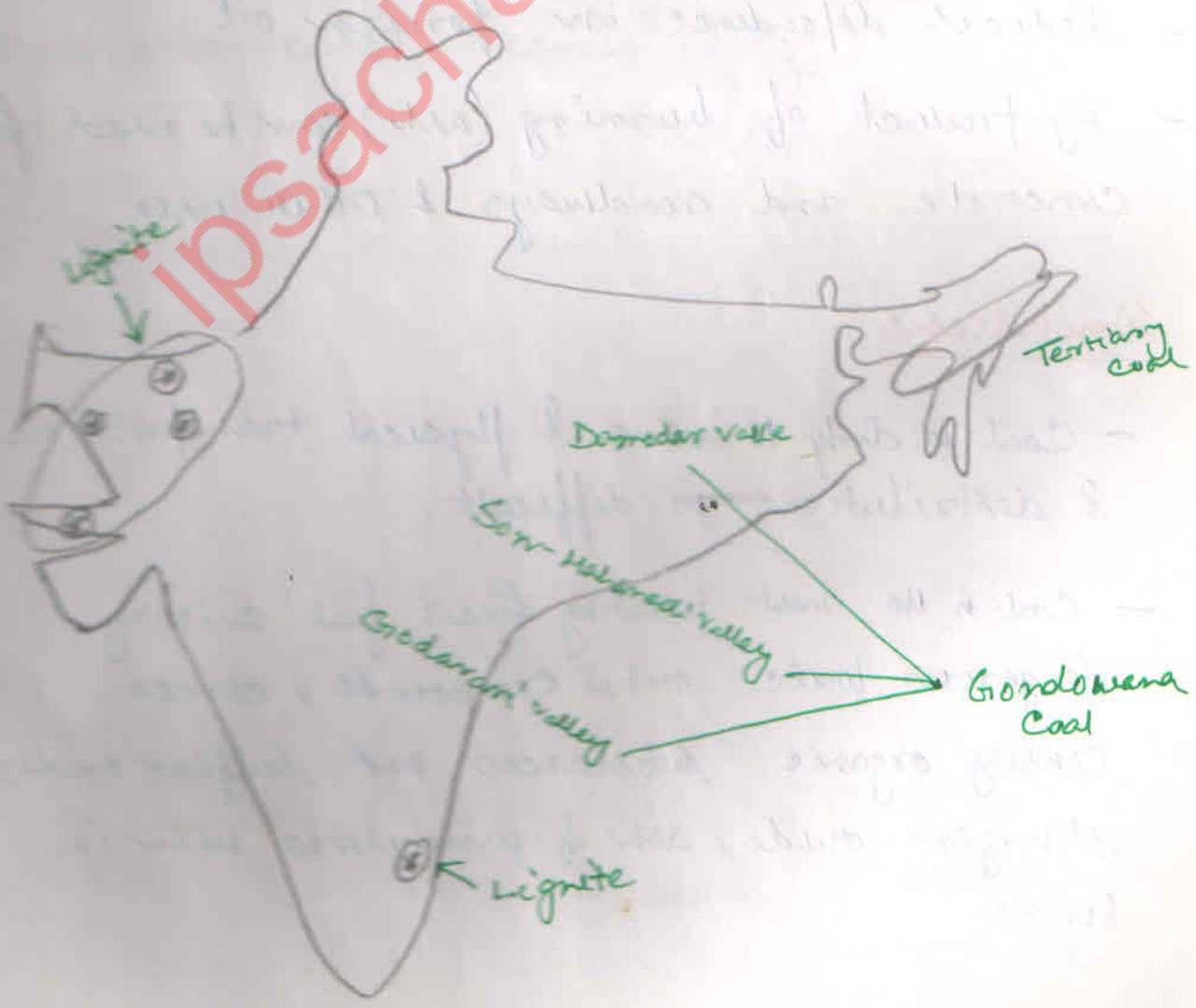
- inferior type of coal, carbon varies between 30% in GJ & RJ to 50% in Assam.

Coal bearing Strata

Oligocene sediments - Tikak parbat formation in Upper Assam, Nagaland & Arunachal

Eocene sediments - Jura Sandstone, Lakadong sandstone in Garo, Khasi & Jaintia hills of Meghalaya

- Sylhet Limestone in Mikir hills of Assam
- Laeyer Subathu group in Jammu.



Merits of Coal :-

- Technology is well developed
- Fairly easy to transport
- Large supplies & large reserves are present
- Coal is versatile, can be burned directly, transformed into liquid, gas or feedstock
- High net useful energy yield
- Relatively cheap
- Leading source of electricity today
- Reduces dependence on foreign oil.
- By-product of burning (ash) can be used for concrete and roadways & other uses.

Limitations :-

- Coal is dirty to mine & physical transportation & distribution is difficult.
- Coal is the most polluting fossil fuel emitting dangerous toxic metal compounds, cancer causing organic substances and Sulphur oxides, Nitrogen oxide, ash & particulates when it burns.

- burning of coal spreads more CO_2 into the atmosphere per unit of heat released than any other fossil fuel.
- Underground coal mining can cause surface land collapse
- It is not useful for powering vehicles in solid form.
- Coal mining mars the landscape
- Liquification, gasification require large amount of waters
- Technology to process to liquid or gas is not fully developed
- higher water content reduces heating value.

From Books

1. Hydro electric Power — P- 144 -148, KS
2. Shale oil — P-152-153 KS
3. Geo thermal energy - P-154-155, KS
4. Wind power — P-155 KS
5. Solar energy - P-156 -157 KS

Agriculture

The geographical analysis of agricultural location is concerned with, both physical & economic factors, although the emphasis in recent years has been placed much more firmly on the process of interaction between these two sets of factors.

Physical Influence on Climate on Agriculture:-

The physical influences on agricultural activity can be divided into three main groups - climate, soils & relief.

1) Climate

i) Water:- All plants need water in order to survive, but their requirements vary widely, as well as their ability to extract water from soil. A continue deficiency or excess of soil-water will ultimately cause the destruction of crops.

In many parts of Scandinavia and Canada, for example, work on the land virtually comes to a standstill during the winter months. The spring snow melt may also cause problems of water logging of fields.

ii) temperature :- Suitable temperature conditions are also essential for the successful germination of seeds and plant growth. Most plants need a minimum temperature of 5-7°C before growth commences.

Note :- accumulated temperature :- The amount by which each day's temperature exceeds a threshold figure is added throughout the growing season to give a cumulative temperature figure.

iii) Frost :- In marginal areas of cultivation where the length of the growing season is scarcely long enough for the successful cultivation of particular crops, serious damage may be caused by spring and autumn ~~fost~~ frost. For e.g., in Finland, which lies at the northern limit of grain farming, there is always a considerable risk of failure because of killing frosts or an unusually short summer.

iv) Light :- Light is also essential for plant growth, & sufficient amounts of sunshine are necessary for the ripening crops. In temperate regions ripening and harvesting of crops may be delayed during unusually cloudy summers.

v) Wind :- Wind affects farming activities in many ways. For e.g. - Damage caused to mature cereal crops by storm winds. Cold local winds such as the Mistral of Southern France may cause serious crop losses, while hot & dry wind such as Sirocco of Southern Italy and Malta may have a desiccating effect upon crops.

The loss of valuable top soil by wind erosion, especially in areas of dry farming where crops are grown under semi-arid conditions without irrigation, is also an extremely serious problem in many parts of the world.

② **Soil**

Soil is the essential material upon which all agriculture is based. It contains minerals such as nitrogen, phosphorus, sulphur, potassium, magnesium, calcium and iron, as well as minute quantities of trace elements such as boron, iodine & cobalt which are necessary for plant growth. All forms of agriculture, whether arable or pastoral, remove certain of these minerals and trace elements from the soil, so that fertility and crop returns will ultimately diminish unless these essential constituents are replaced. Soil fertility may be maintained by following, scientifically based crop rotations, and the application of manure of chemical fertilisers.

③ **Relief** Three elements of relief – altitude, aspect and gradient – influence patterns of agricultural activity.

i) **Altitude**:- Increased altitude generally includes higher precipitation, strong winds and a deterioration of soil quality. Higher altitude therefore restricts the number & types of

crops that may be grown.

In Southern Scotland the length of the growing period decreases from about 240 days at sea level to about 180 days 330m & 135 days at 600m

In tropics, increased altitude provides some relief from the excessive high temperature and humidity of the lowland plains and provides an improved environment for many crops. For e.g. in Java, the best crops of tea are grown at heights of 1200 – 1800m.

ii) aspect or orientation of slope: In the northern hemisphere, south-facing slopes receive longer periods of more intensive sunshine, than their north-facing counterparts. Although, the temperature differences between the sunny (adret) and shady (ubac) slopes are quite small, they are nevertheless sufficient to cause significant differences in the land use and settlement patterns of two opposing valley sides.

iii) Gradient of slope: Not only, the risk of soil erosion is greater on steep slopes, than on gentle ones, but

also steep gradients greatly restrict the use of heavy machinery. For. e.g. the use of combine harvesters is normally restricted to slopes of less than 10°. In many parts of the world, especially in South-East Asia, complex system of terracing have been developed to allow steep hillsides to be brought under cultivation.

The physical factors outlined above should not be thought of as absolute controls which impose rigid, unchanging limits on agricultural production. Soils can be modified and improved by the application of fertilisers designed to compensate mineral deficiencies, inadequate soil drainage can be improved by tile drains, ditches and pumping, farming can be extended into areas of low and unreliable rainfall by irrigation schemes, and the geographical limits of particular crops extended by plant breeding. But, All of these developments are associated with enormous cost. This in turn implies a strong demand and high returns for the products in order to justify the capital expenditure involved.

Social & Economic Influences on Agriculture

i) **Land Tenure**: Land tenure has one of the most fundamental influence on agriculture. Various forms of land tenure are found, which include freehold ownership, various forms of tenancy and communal & state ownership.

Freehold ownership is the dominant form of land holding in most advanced farming nations. The owner-occupier is free to subdivide his holding between his heirs.

Two forms of tenant farming may be noted. The most common is cash tenancy, in which a fixed cash rent is paid to the land owner. The second form is share-cropping or metayage, whereby the tenant cultivates the land and gives the owner an agreed share of the farm produce.

State ownership of both land and the capital equipment of agricultural production represents another form of tenancy which has been established in most countries of the communist

world. State control of agriculture may be seen as attempt to rationalise and modernise agricultural production, achieve economies of scale and eliminate many of the problems common to peasant cultivators, such as small size and fragmentation of holdings.

However, the collective farms (kolkhozy) and state farms (sovkhozy) of the Soviet Union have not been an unqualified success. It has been suggested that 'the yield or fertility of the soil has not been very materially improved, although the productivity of agricultural labour has been considerably increased.

ii) Scale of Operation: The economic viability of a farm of a given size is difficult to asses, and depends on the type, method and intensity of production as well as the economic aspirations of the farmer and the social context, within which farming is carried out.

Under the system of intensive, subsistence rice growing practiced in South-East Asia, one hectre of land is sufficient

to support a family, whereas on the drier parts of the Great Plains of the USA, a farm of 200 ha is considered small and would scarcely support a family.

Because of limited returns from small farms, farmers frequently engage in a secondary occupation to supplement the farm income. In France, Germany, Poland many 'worker-peasants' or '5-0'clock farmers', as they have been termed, combine the running of a small holding with a full time job in nearby urban centres.

Another response to the problems of small unit size is that of co-operation between groups of farmers. In countries such as Denmark, Netherland, Finland, where co-operative schemes have been encouraged and financed by the State, the organization embraces agricultural education, quality control and processing of products, as well as marketing and advertising. Extreme forms of co-operative organisations are found in Israel in the form of kibbutzim, in which small family farms share centralised co-operative services, and

the Kibbutzim, which involve complete communal ownership of the land.

Programmes of farm consolidation have been carried out in many West European countries, asian countries, but resulted in 'partial success.

Marketing: Apart from purely subsistence economies, patterns of farming are greatly influenced by demand for particular products. Other things being equal, preference will be given to commodities for which there is a strong demand ~~with~~ with high profit. However simple relationships between supply and demand are greatly complicated by government intervention in the form of subsidies, tariffs, quota restrictions & various international trading agreements.

In most cases farmers cannot retain his product, until market prices are high. The economic vulnerability of the individual farmer may be strengthened by the formation of growers associations or co-operative groups

for the processing and marketing of produce. These type of arrangement has been successfully applied to cheese-making in Switzerland & the Netherlands, wine production in France.

Transport:- Transport provides the essential link between agricultural producer and buyer, as well as the means of moving various material inputs such as seeds, fodder and fertilisers to the farmer. The cost of transporting produce to market forms a central theme in **Von-Thunen's** theory of agricultural location.

The advent of refrigerated shipping in 1870s transformed the farming face of Australia, New Zealand & Argentina by permitting the movement of frozen beef and mutton to European markets.

Labour:- Availability and cost of labour will play an important part in determining the farmer's choice of crops & livestock. Low population densities and shortage of labour in a region tend to restrict agriculture to forms and methods requiring little labour in relation to land, such as extensive highly-

mechanised grain cultivation or stock ranching Conversely a high population density and abundance of labour will favour labour intensive forms of production such as cultivation of paddy-rice or market-gardening.

Capital

According to W.B. Morgan – The development of agribusiness with its capital intensive and vertically integrated production systems is reducing the relative significance of land & labour and emphasising the importance of capital deployment and marketting skills.

In developed economies capital may be raised by privately negotiated loans from finance or mortgage companies, or from banks but in developing countries funds are less readily available to farmers.

Rural indebtness is prevalent among peasant farmers in South-east Asia, the Middle East and Southern Europe. Thus the available capital is too small to modernise the farm & for improvement of agriculture.

Government Influences

It is obvious that stable government tends to promote stable economic conditions, which in turn encourage capital investment in agriculture as in other forms of economic activity. More specifically, government policies and attitudes towards land taxes, food prices, wage levels, freight rates and food imports all have a profound and direct influence on agricultural production.

Government action operates at two levels: first through policies affecting the internal organisation of agriculture and secondly through controls on external trade.

Problems of Delimitation and Classification of agricultural regions :-

It is obvious that the farms in any area will have an almost unlimited number of attributes such as size, form of tenure, degree of fragmentation, size of labour force, type of production and value of output, to name just a few. Since it is highly unlikely that there will be completely spatial correlation in the degree of variation of these attributes, it may be argued that for any given area there are a number of sets of agricultural regions, depending on the criteria selected. The sets will not necessarily coincide. Such agricultural regions are termed as single feature or special-purpose regions.

Alternatively, it can be argued that while all the attributes of the farms are unlikely to co-vary exactly, they can be reduced to a single index figure

and agricultural regions delimited according to the distribution of these index values. Working in this way, it is possible to produce a system of multiple feature or general-purpose regions.

Most schemes of classification of World agriculture attempt to formulate a system of general purpose region, although care must be taken to employ criteria, which are capable of quantification and which emphasise elements or characteristics of the farming system rather than factors. H. Engelbrecht in 1930 proposed a classification of World agriculture, which consisted of little more than a map of World climatic regions with the substitution of an agricultural nomenclature.

D. GRIGG recommended a number of basic criteria, which should be taken into account. These were — degree of commercialisation, type of tenure and scale of enterprise, intensity of farming, crop and livestock combination, and methods of farming.

Though these factors provide a logical basis for agricultural classification, but in practice there application poses many problem. For eg - with increasing cultivation of cash crops, the traditional distinction between subsistence and commercial farming is none for less clear than earlier.

Again, Dairying in the UK and rice-growing in South-East Asia are both intensive systems of agriculture, but one is Capital intensive, the other labour intensive

WHITTLESEY'S AGRICULTURAL TYPOLOGY

Agricultural regionalisation was first taken up by H. Engelbrecht in 1930 on basis of physical criteria. Agricultural regions hardly look better than another climatic map. According to D. Grigg, physical factors are largely static but agricultural patterns are fastly changing due to input of modern technology & sciences. He suggested agricultural typology as sole criteria for such classification.

Meaning of Typology:- Typology is the sum total of agricultural pattern, the methods applied, farm practices, aspiration of the farmers & the nature of farming. Typology reflects the cropping pattern, crop combination, degree of mechanisation, commercialisation, intense of land use and agricultural infrastructure, use of modern input, technological applications etc.

Criteria or Basis of D. Whittlesey's classification

↓

(1936) evaluated on the basis of points raised by D. Grigg

① **Crop and Livestock combination**:- It includes such pattern like crop monoculture to mix farming (crop + livestock) to mix cropping (different crops).

② **Intensity of land use**:- It means no of time, the same piece of land is cultivated in a given year. Extensive farming has a very low intensity of land use while intensive farming has high intensity of land use. For e.g — Temperate grasslands have extensive farming, while monsoon lands have intensive farming.

③ Processing & marketing of farm produce: subsistence agriculture has zero commercialisation, while plantation agriculture is fully commercialised.

④ Degree of mechanisation: Hoe culture (tribal agriculture) is totally carried out with traditional method, while prairie agriculture is highly mechanised.

⑤ Structural Component: It emphasises on agricultural infrastructure like cold storage, road trasport, marketting facilities etc.

Bases on these criteria Whittlesey classified the world agricultur in 13 types (fig-1).

Classification of World Agriculture into Systems

In classification of the World's agriculture a four-level frame was recognized by Anderson (1970) namely ecological, subsistence, commercial and collective agriculture system.

① At the ecological or near ecological level, natives utilize natural plants and breed

TYPES OF WORLD AGRICULTURE (D. WHITTLESEY)

1. Nomadic Herding
2. Livestock Ranching
3. Shifting Cultivation
4. Rudimental sedentary tillage
5. Intensive subsistence tillage, rice dominant
6. Intensive subsistence tillage without paddy rice
7. Commercial plantation
8. Mediterranean agriculture
9. Commercial grain farming
10. Commercial Livestock & crop farming
11. Subsistence crop & livestock farming
12. Commercial dairy farming
13. Specialised horticulture.

animals by primitive methods. (2) At the subsistence level, which may be subdivided into the least primitive and intensive subsistence sub types, the agricultural produce is raised primarily for consumption at home and very little is traded. Practically none of the farm commodities produced at the subsistence level, comes into the world trade.

(3) At the commercial level, agricultural production is mainly for sale, since very often little farm produce is consumed at home.

(4) At the collective level, the systems are similar to the commercial ones in terms of crops produced and livestock raised, but differ markedly in organization and decision-making in the production process.

In addition to these four levels, the cash cropping agricultural system is a fifth level. It is distinguished from commercial and collective farming in the sense that in the former the maximum produce is marketed to the outside world.

The framework of the agricultural systems of the world, except collective farming as outline by Whittlesey may be presented as under :-

(A) Ecological or Near Ecological Systems :-

1. Nomadic Herding — Nomadi.
2. Shifting cultivation.

(B) Subsistence Systems :-

3. Rudimentary Sedentary Tillage
4. Intensive subsistence tillage (with paddy dominance)
5. Intensive subsistence tillage (without paddy dominance)

Intensive Subsistence tillage ←

6. Subsistence crop & livestock farming (in monsoon land)
7. Mediterranean Agriculture (near subsistence in the occidental World)

(C) Commercial Systems :-

8. Mediterranean Agriculture (commercial in the new or oriental World)
9. Livestock ranching
10. Commercial grain farming.
11. Commercial livestock & crops farming
12. Commercial dairy farming
13. Specialised Horticulture and olericulture (fruit & vegetable culture) farming

(D) Collective farming system :- (* not by Whittlesey)

14. State farming
15. Co-operative farming

(E) Cash cropping system

16. Commercial plantation farming