

- ▶ **Nagendra Raj Sitoula**
- ▶ **Department of Civil Engineering**

Background Perspectives:

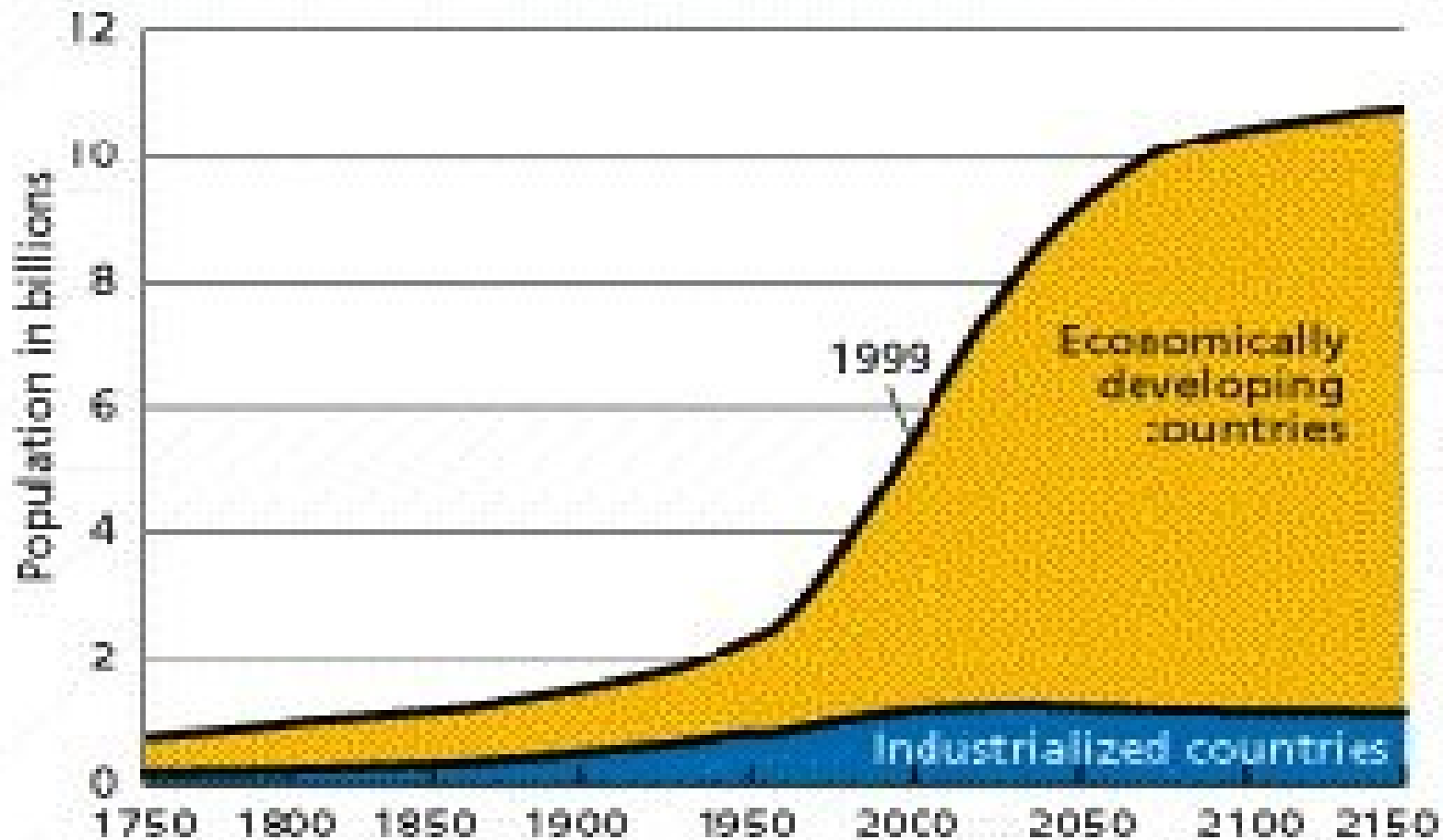
- ▶ **Course Objective:**
- ▶ **To familiarize the students with their roles in the society, ethical and legal environment in which engineering is practiced, contract administration, regulatory environment and contemporary issues in Engineering**

Greatest achievements of 20th

1. Electrification
2. Automobile
3. Airplane
4. Water Supply and Distribution
5. Electronics
6. Radio and Television
7. Agricultural Mechanization
8. Computers
9. Telephone
10. Air Conditioning and Refrigeration

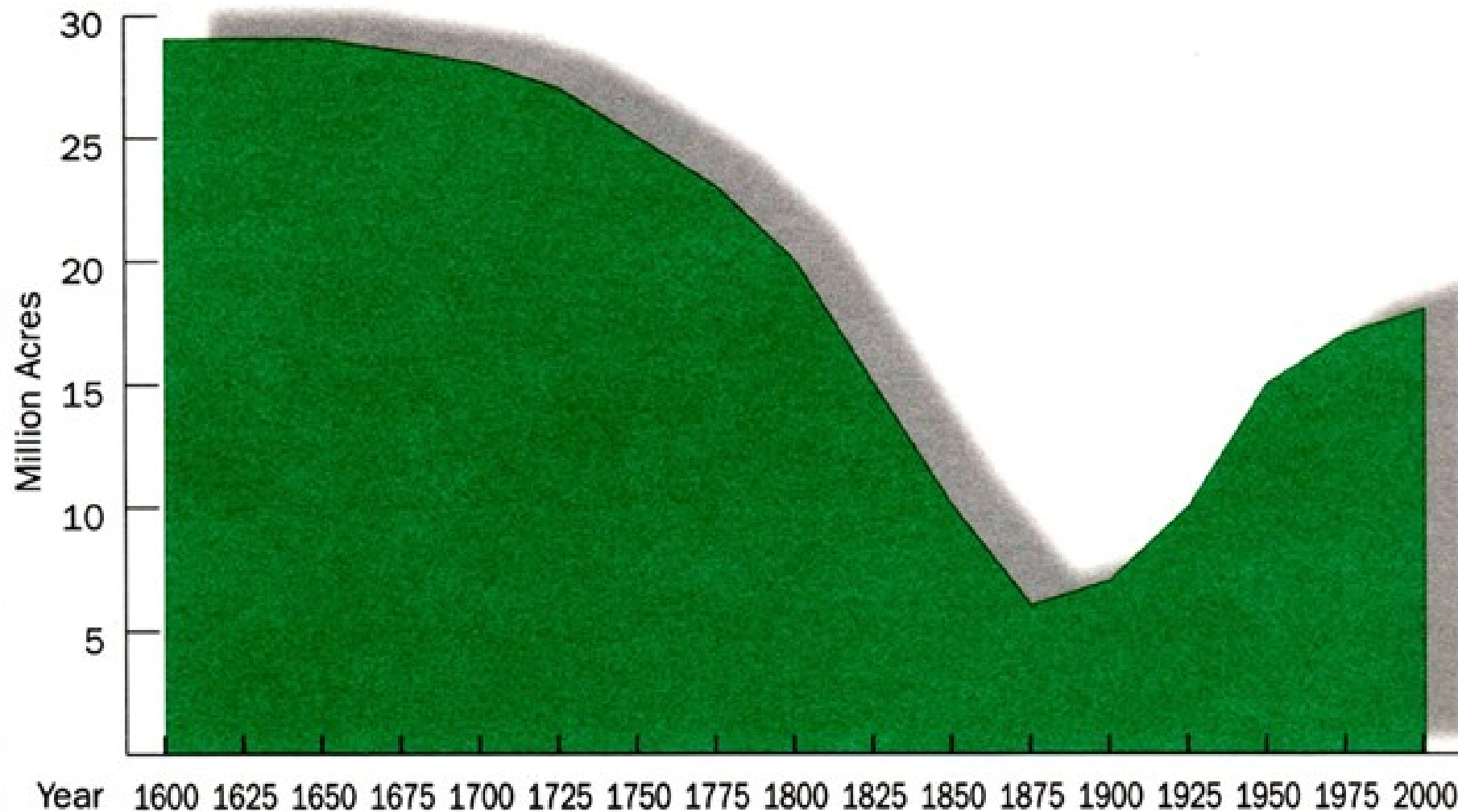
1. Highways
2. Spacecraft
3. Internet
4. Imaging
5. Household Appliances
6. Health Technologies
7. Petroleum and Petrochemical Technologies
8. Laser and Fiber Optics

World Population Growth, 1750–2150



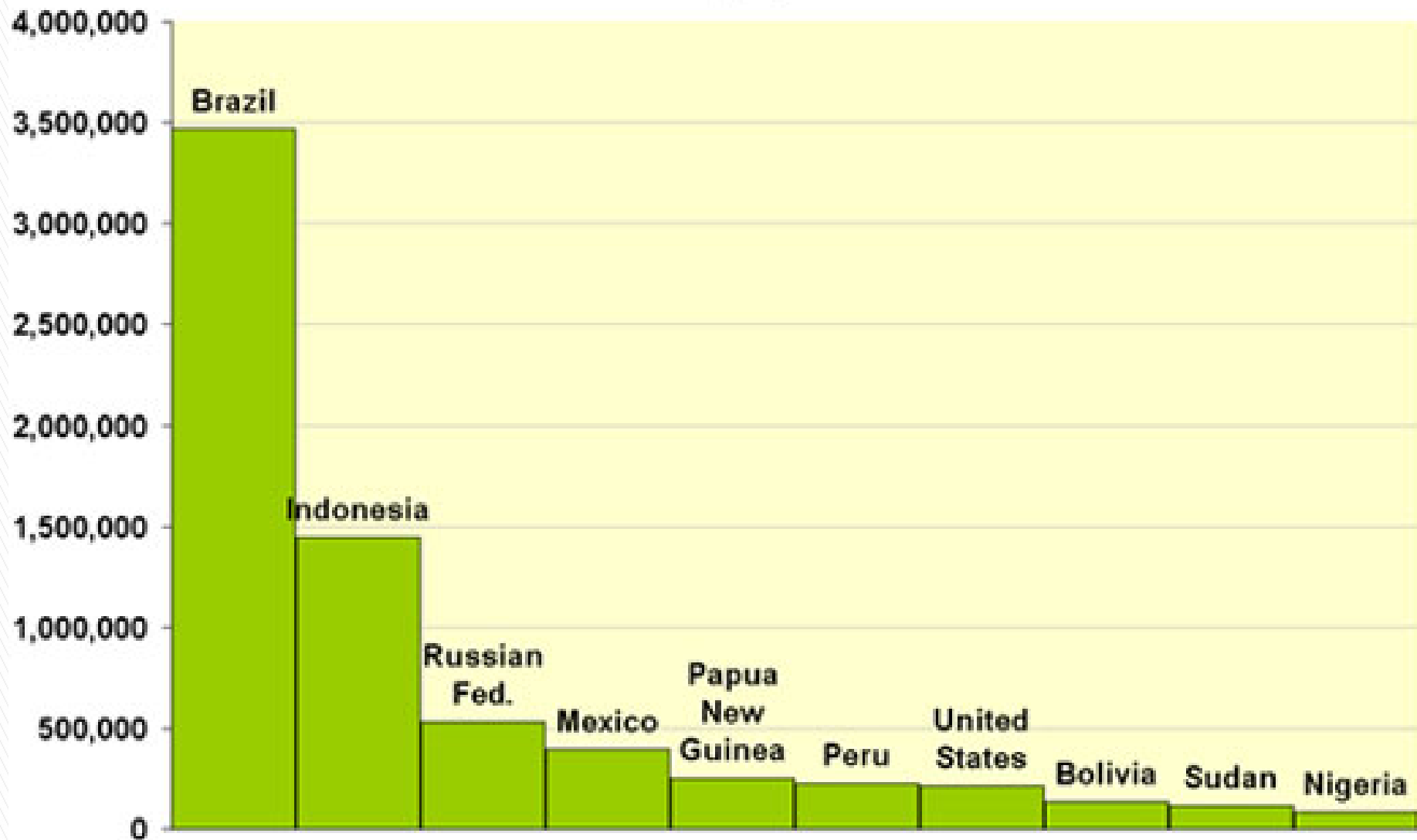
Exponential growth

Changes in New York's Forest Land Area



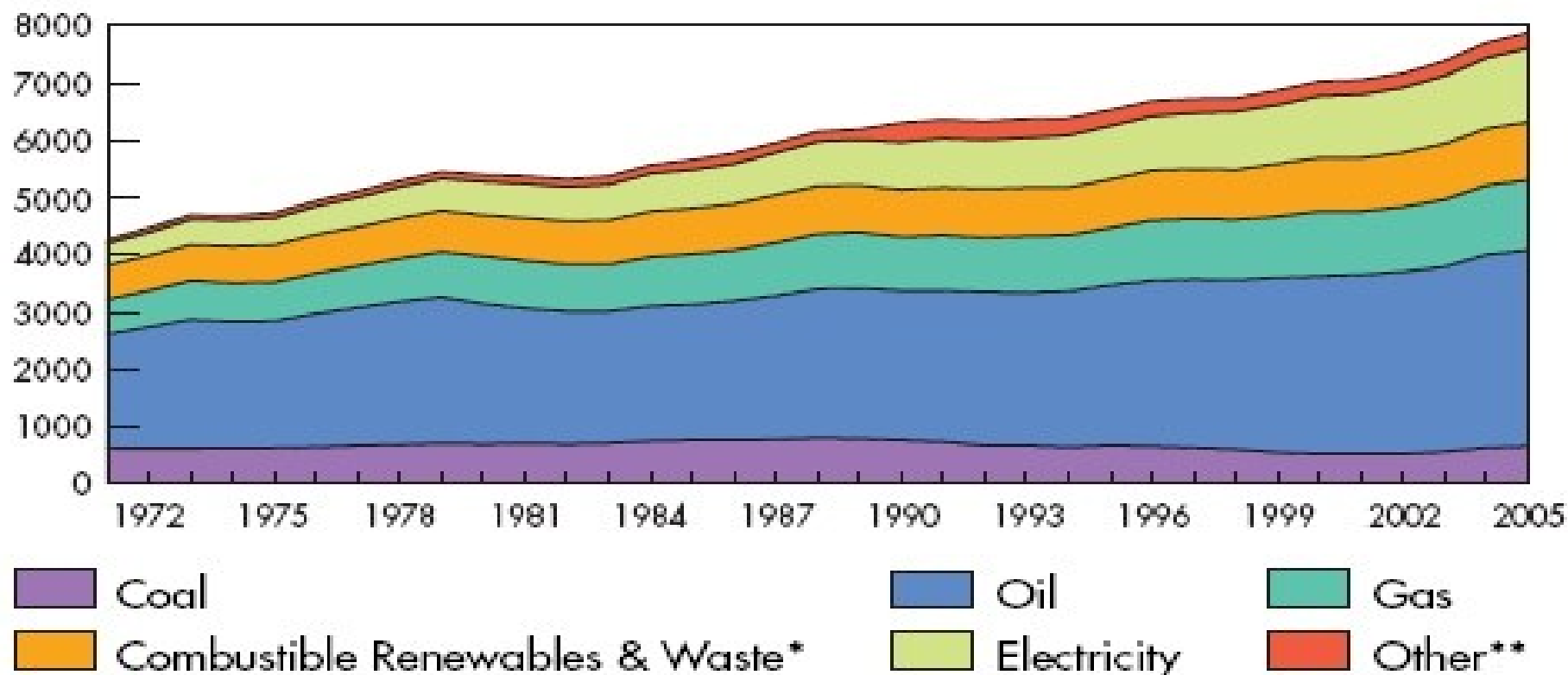
Area of forest in new york'

Highest deforestation of natural forests, 2000-2005. All countries.
Hectares per year



deforestation

Evolution from 1971 to 2005 of World Total Final Consumption by Fuel (Mtoe)



* Prior to 1994 combustible renewables & waste final consumption has been estimated.

**Other includes geothermal, solar, wind, heat, etc.

Fuel consumption



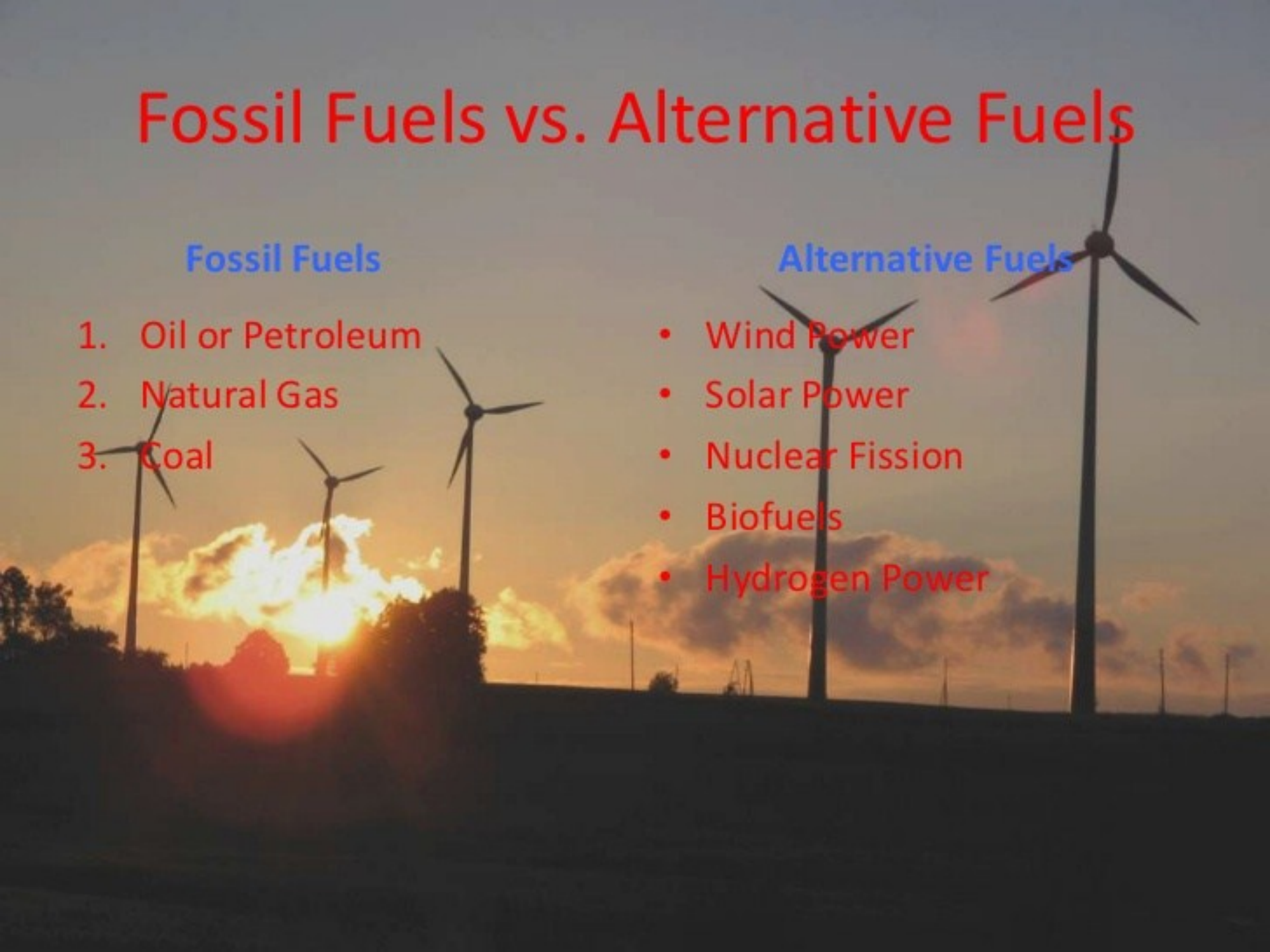
Fossil Fuels vs. Alternative Fuels

Fossil Fuels

1. Oil or Petroleum
2. Natural Gas
3. Coal

Alternative Fuels

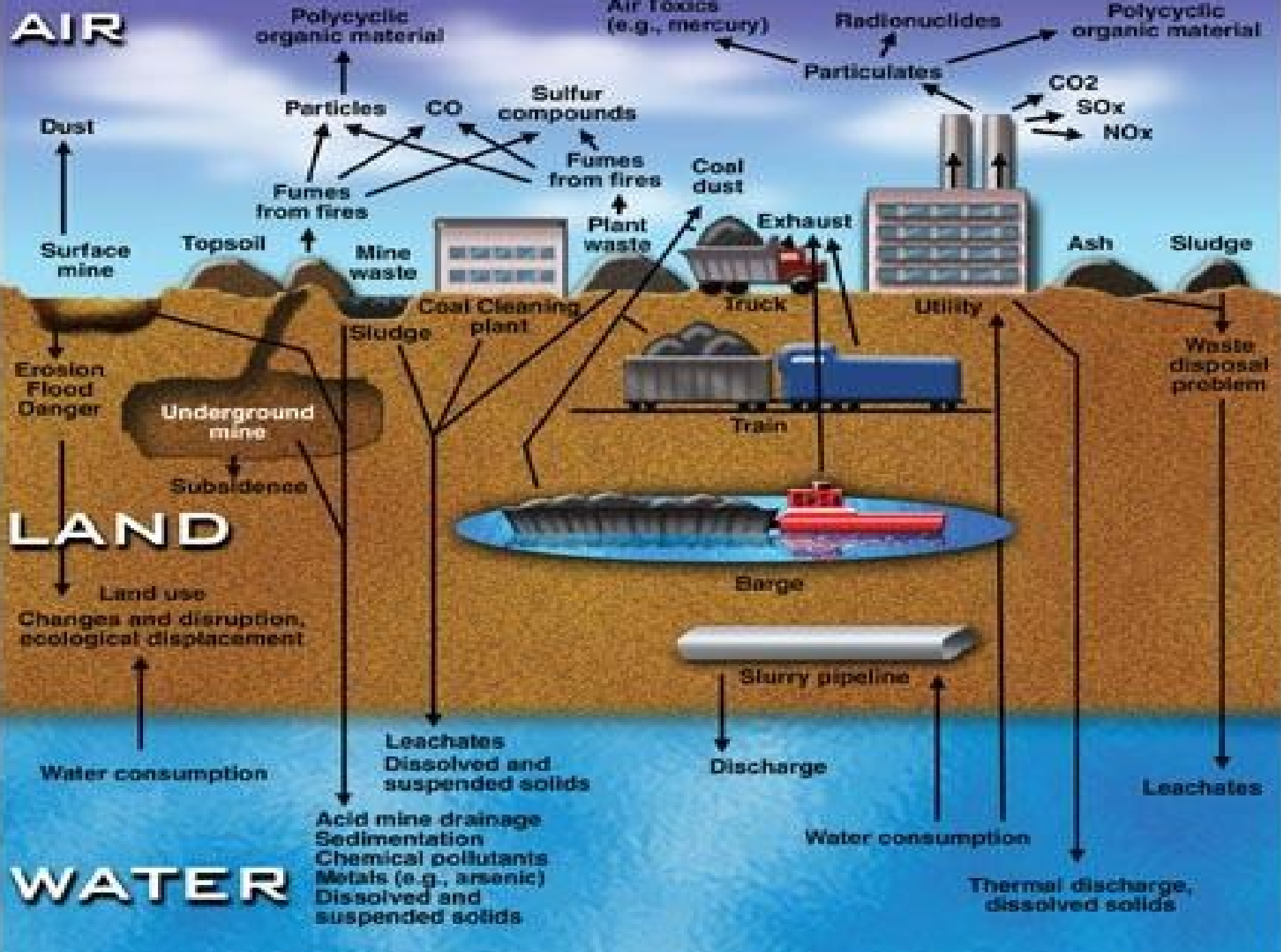
- Wind Power
- Solar Power
- Nuclear Fission
- Biofuels
- Hydrogen Power



AIR

LAND

WATER

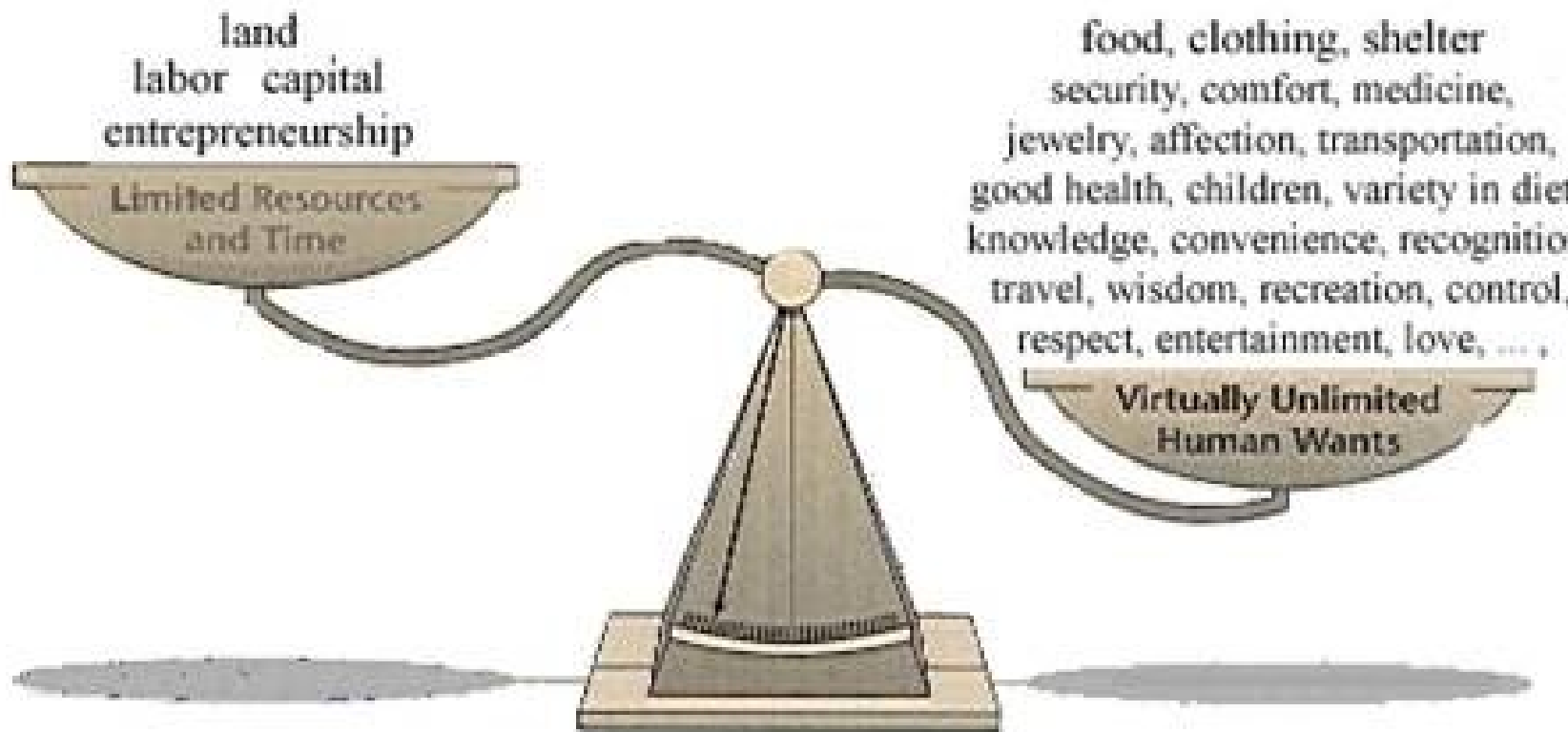








SCARCITY



scarcity



Discussion




causes of international tensions

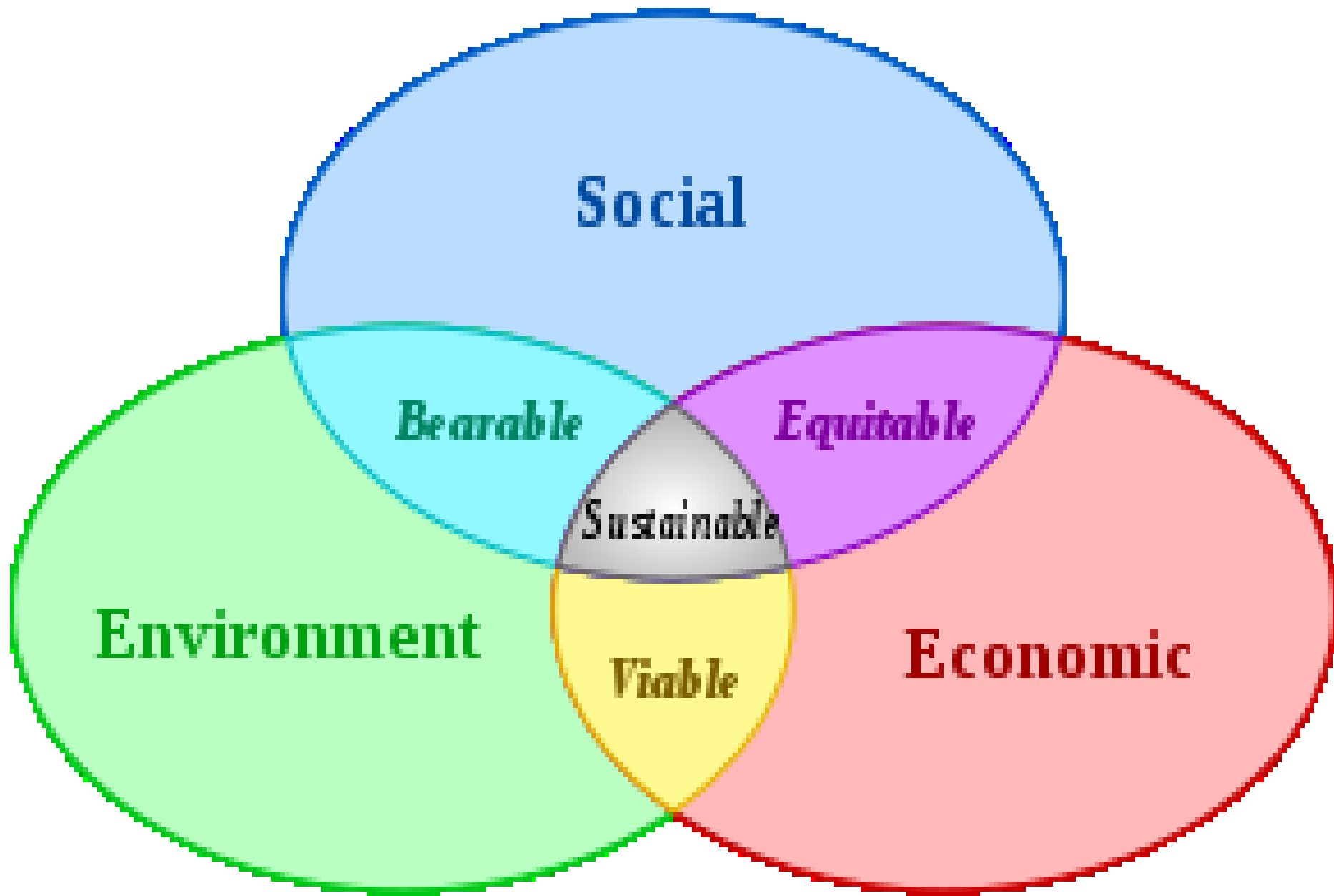


Drinking Water crisis

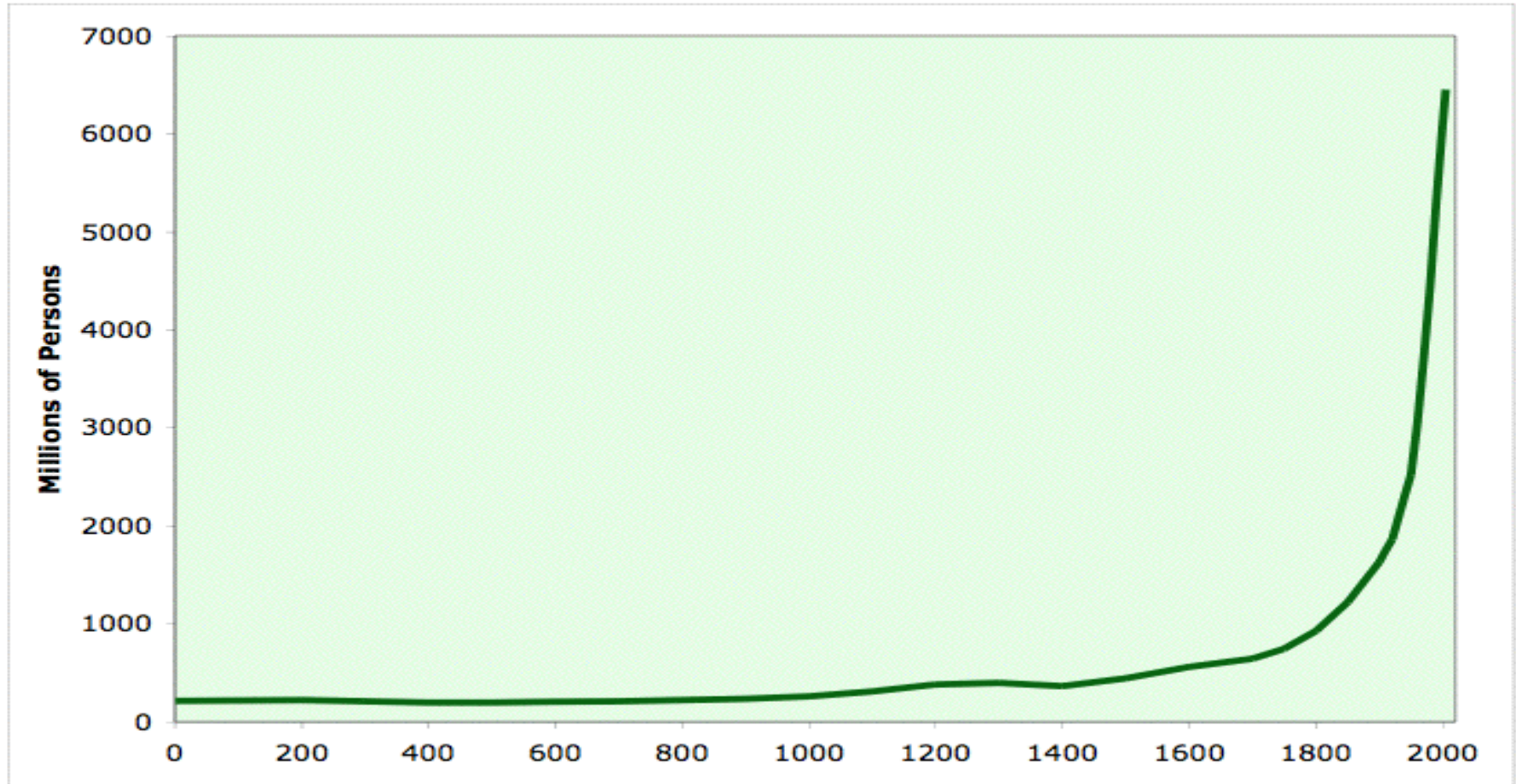
Chapter 1

▶ **History of Engineering Practices [3 hours]**

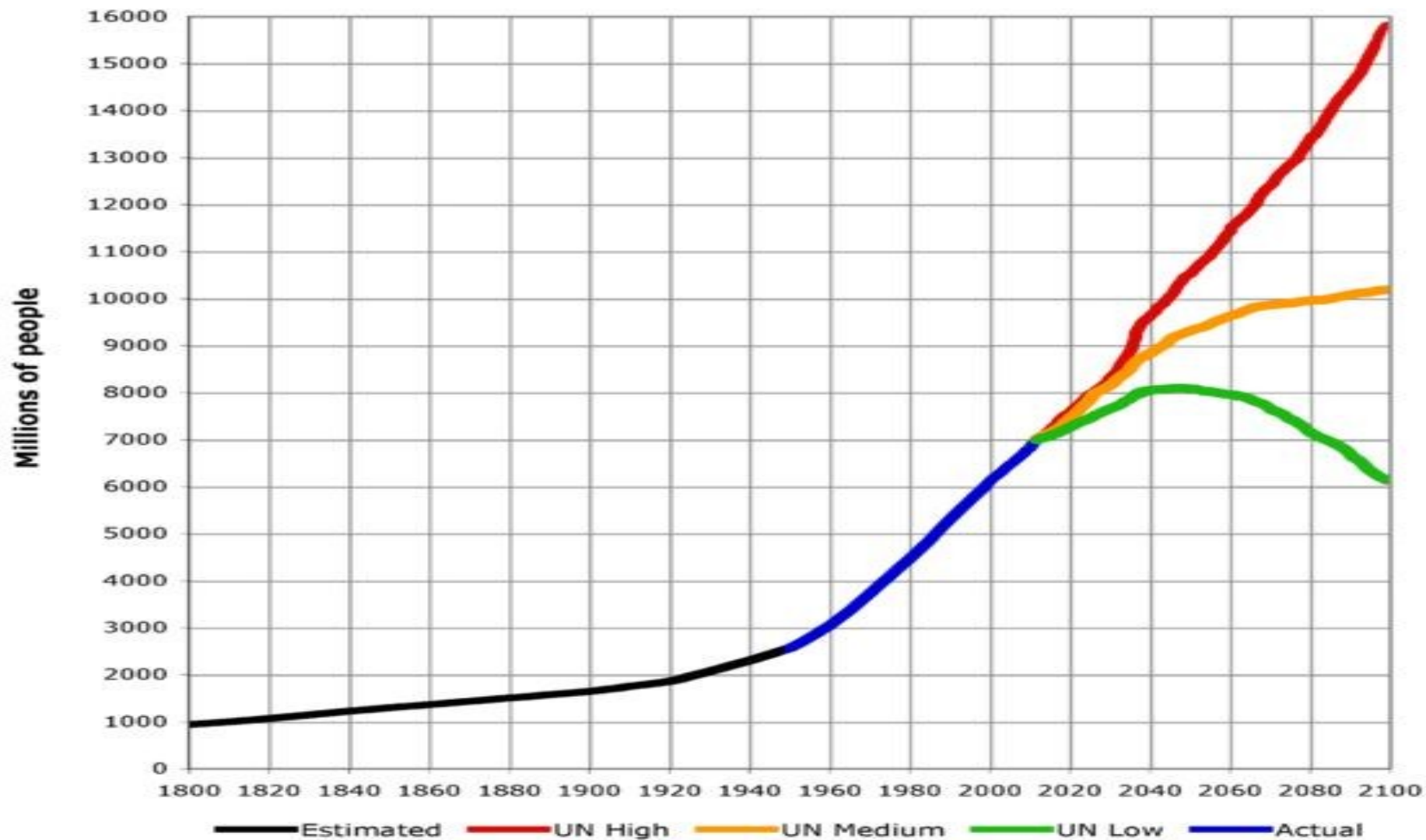
- 1. Man and Society**
 - 2. Technology and Society**
 - 3. History of Engineering Practice in Eastern Society**
 - 4. History of Engineering Practice in Western society**
 - 5. Engineering Practices in Nepal**
- 



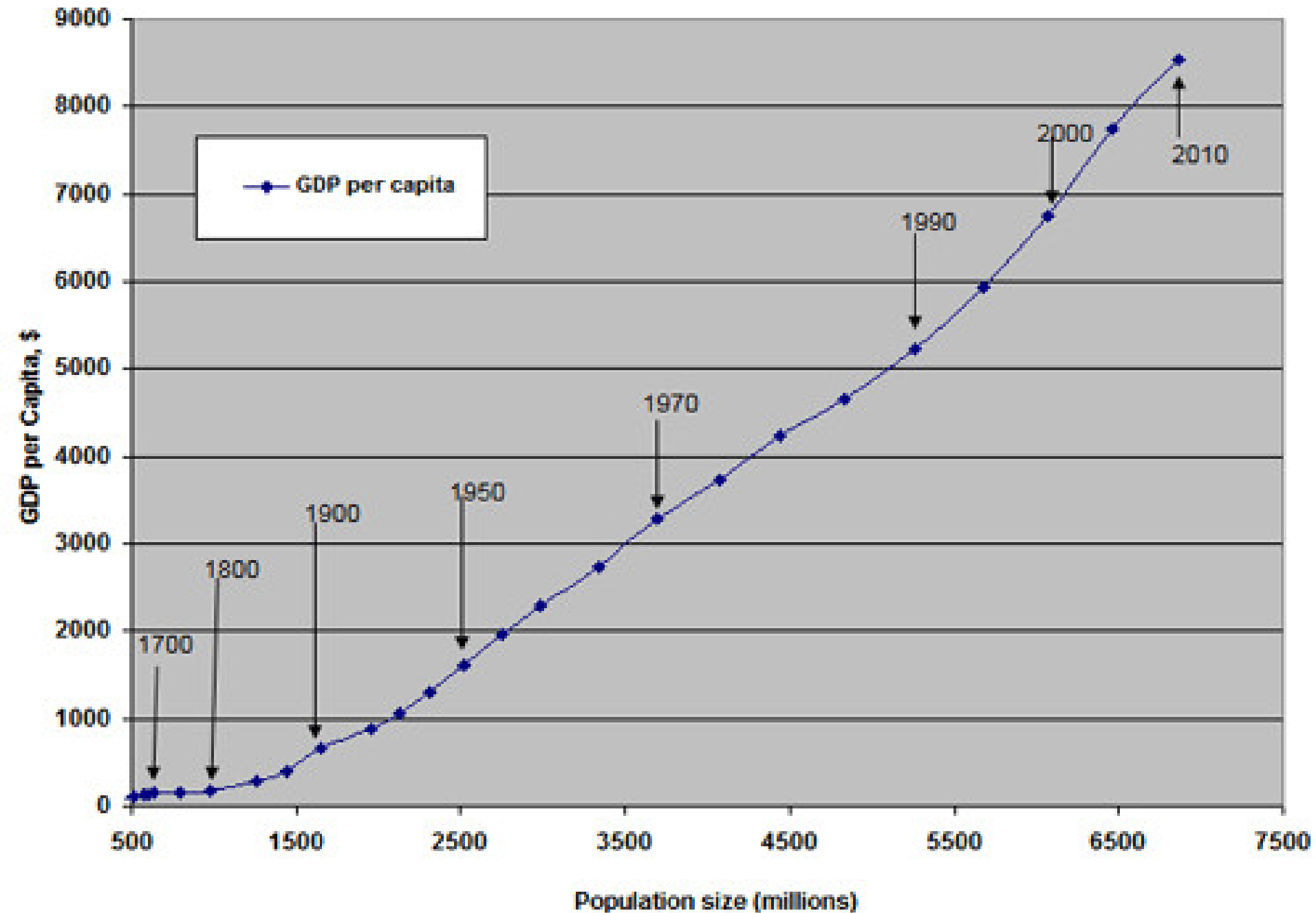
POPULATION OF WORLD



WORLD POPULATION



GDP per capita vs Population 1500-2010



- ▶ **One of the most significant of all social changes is the transition from pre-industrial to an industrial type of society. Based on the socioeconomic development of the society, the societies of the world have been grouped into three categories as first world, second world, and the third world.**
- ▶ **First world: Countries such as North America, Western Europe, Australia, Japan, Singapore etc. are grouped as first world. These countries are industrialized, stable and developed.**
- ▶ **Second world: Countries such as Eastern Europe, Malesia etc. are grouped as second world. They are less industrialized and developed.**
- ▶ **Third world: Countries like Nepal, Bangladesh etc. are grouped as third world. They are less industrialized and underdeveloped.**

- ▶
- ▶ **Characteristics of developing countries are:**
- ▶
- ▶ **Poverty**
- ▶ **Unemployment**
- ▶ **Limited access to education and health care**
- ▶ **Poor level of nutrition and health**
- ▶ **Immature and unbalanced economies**
- ▶ **Unstable political climate**
- ▶ **Male dominated societies**
- ▶ **Belief in religion**
- ▶ **Lack of scientific/technical infrastructure**
- ▶ **Less respect for time**
- ▶



Cultures of East and West

There is a difference between the cultures of East and West. Western culture attaches significant values to the material gains achieved by individuals. Hence, the Western culture evaluates things giving more and more comfort to the individual.

Eastern culture attaches significant values to high morality, power of truth, achieved by individuals and achievements in religious activities etc are regarded higher than those acquiring materialistic and physical objects. Eastern culture to the group of people is a family, a community and a society as a whole. Eastern culture especially exhibits due respect to the old.

- ▶
- ▶
- ▶ **Western values**
- ▶

- ▶ **Achievements and success**

- ▶ **Activity and work**

- ▶ **Moral orientation**

- ▶ **Efficiency and practicability**

- ▶ **Progress**

- ▶ **Material comfort**

- ▶ **Equality**

- ▶ **Freedom**



- ▶ **Use of technology**

- ▶ **Individualistic**

- ▶ **High concern over time**

- ▶ **The term refers to how input is transferred to output. Technology is a systematic knowledge which facilitates in the use of machines and tools. One of the most distinctive of all human characteristics is that men are tool-using animals. People have used increasingly sophisticated techniques to act on the social and the natural world for thousands of years and they have done so in many ways that have transformed, and continue to transform, the very conditions of life on this planet.**
- ▶ **Over the generations, simple tools and machines made by human beings such as the knife, the wheel, the plough, the compass, the clocks, the printing press, the steam engines, the nuclear reactors, the computer, the mobile phones, etc have dramatically influenced our social and natural surroundings. These all are the examples of technologies, the practical application of scientific or other knowledge.**
- ▶ **Technology and social change are intimately connected, particularly in the modern world, where rapid technological and social change tends to go hand in hand. Many people in modern societies seem to implicitly assume that technological development and human progress is much the same thing.**



- 
- ▶ **According to Wikipedia - Technology and society or technology and culture refers to the cyclical co-dependence, co-influence, co-production of technology and society upon the other (technology upon culture, and vice-versa). This synergistic relationship occurred from the dawn of humankind, with the invention of the simple tools; and continues into modern technologies such as the printing press and computers.**
- 

Impact and consequences of technology on society

- ▶
- ▶ **1. Modern examples of technological development**
- ▶ **2. Economics and technological development**
- ▶ **3. Values**
- ▶ **4. Ethics**
- ▶ **Challenges traditional ethical norms:**
- ▶ **Creates an aggregation of effects:**
- ▶ **Changes the distribution of justice:**
- ▶ **Provides great power:**
- ▶ **5. Lifestyle**
- ▶ **6. Institutions and groups**
- ▶ **7. International**
- ▶ **8. Environment**

Impact and consequences of technology on

- ▶ **Modern examples of**
- ▶ **There are extraordinary number of examples how science and technology has helped us that can be seen in society today.**
- ▶ **The mobile phone is the great example of modern technology.**
- ▶ **The invention of the mobile phone, which did, and still does, greatly influence society and the way people live their lives. Now many people are accessible to talk to whoever they want no matter where any of the two people are.**
- ▶ **All these little changes in mobile phones, like Internet access, are further examples of the cycle of co-production.**

technological development

- ▶ **Time line**
- ▶ **today's modern media player.**
- ▶ **At the beginning, cassettes**
- ▶ **that method was large and cumbersome**
- ▶ **so the manufactures developed compact disks,**
- ▶ **which were smaller and could hold more data.**
- ▶ **Later, compact_disks were again too large and did not hold enough data that forced today's manufactures to create MP3 players, which are small and holds large amount of data.**
- ▶ **Today's society determined the course of events that many manufactures took to improving their products so today's consumers will purchase their products.**

.... influenced the way we live our lives.

- ▶ Looking back into ancient history, **economics** can be said to have arrived on the scene when the occasional, spontaneous exchange of goods and services begin to occur on a less occasional, less spontaneous basis.
- ▶ Clearly, regardless of the goods and services bartered, some amount of technology was involved—if no more than in the making of shell and bead jewelry. So, from the very beginning, technology had encouraged the development of more elaborate economies.
- ▶ In the modern world, superior technologies give rise to robust economies. In a well-functioning, robust economy, economic excess naturally flows into greater use of technology, because technology is such an inseparable part of human society.
- ▶ Many foundations and other nonprofit organizations contribute to the development of technology.

Economics and technological development

- ▶
- ▶ The implementation of technology influences the values of a society by changing expectations and realities. The implementation of technology is also influenced by values. Three major interrelated values of technological innovations are:
 - ▶ **Mechanistic world view**: Viewing the universe as a collection of parts, (like a machine), that can be individually analyzed and understood.
 - ▶ **Efficiency**: A value, originally applied only to machines, but now applied to all aspects of society, so that each element is expected to attain a higher and higher percentage of its maximal possible performance, output, or ability.
 - ▶ **Social progress**: The belief that there is such a thing as social progress, and that, in the main, it is beneficent.

▶ According to Winston (2003), four major ethical implications of technological development are:

▶ Challenges traditional ethical norms:

Because technology impacts relationships among individuals, it challenges how individuals deal with each other, even in ethical ways.

▶ Creates an aggregation of effects:

One of the greatest problems with technology is that its detrimental effects are often small, but cumulative.

the case with the pollution from the burning of fossil fuels in automobiles.

Each individual automobile creates a very small, almost negligible, amount of pollution, however the cumulative effect could possibly contribute to the global warming effect.

Other examples include accumulations of chemical pollutants in the human body, urbanization effects on the environment, etc.

- ▶ **Changes the distribution of justice:**
- ▶ **The important quality with technology tends to have higher access to justice systems. Or, justice is not distributed equally to those with technology versus those without.**
- ▶ **Provides great power:**
- ▶ **Not only does technology amplify the ability, and hence the strength, of humans, it also provides a great strategic advantage to the human(s) who hold the greatest amount of technology.**
- ▶ **For example, Bill Gates has considerable influence (even outside of the computer industry) in the course of human affairs due to his successful implementation of computer technology.**

- ▶
- ▶ In many ways, *technology simplifies life.?*
- ▶ **The rise of a leisure class**
- ▶ **A more informed society, which can make quicker responses to events and trends**
- ▶ **Global networking**
- ▶ **Creates denser social circles**
- ▶ **Cheaper prices**
- ▶ **Greater specialization in jobs**

- ▶
- ▶ **In other ways, *technology complicates life.***
- ▶ **Pollution is a serious problem in a technologically advanced society (from acid rain to Chernobyl and Bhopal)**
- ▶ **The increase in transportation technology has brought congestion in some areas**
- ▶ **New forms of danger existing as a consequence of new forms of technology, such as the first generation of nuclear reactors**
- ▶ **New forms of entertainment, such as video games and internet access could have possible social effects on areas such as academic performance**
- ▶ **Increased probability of some diseases and disorders, such as obesity**
- ▶ **Social separation of singular human interaction. Technology has increased the need to talk to more people faster.**

technology complicates life.

- ▶
- ▶ **Technology often enables organizational and bureaucratic group structures that otherwise and heretofore were simply not possible. Examples of this might include:**
- ▶ **The rise of very large organizations: e.g., governments, the military, health and social welfare institutions, supranational corporations.**
- ▶ **The commercialization of leisure: sports events, products, etc.**
- ▶ **The almost instantaneous dispersal of information (especially news) and entertainment around the world.**
- ▶

- ▶
- ▶ **Technology enables greater knowledge of international issues, values, and cultures. Mostly due to mass transportation and mass media, the world seems to be a much smaller place, due to the following, among others:**
- ▶ **Globalization of ideas**
- ▶ **encourage of values**
- ▶ **Population growth and control**
- ▶ **Others**
- ▶

- ▶
- ▶ **Technology provides an understanding, and an appreciation for the world around us.**
- ▶ **Influence of technological change on society**
- ▶ **Family system and technological change**
- ▶ **Religion and technological change**
- ▶ **Rural life and technological change**
- ▶ **Urban life and technological change**

- ▶ **Mass production of goods through machines automation**
- ▶ **Faster means of transportation**
- ▶ **Mass communication**
- ▶ **Availability of labor saving device**
- ▶ **Faster pace of life**
- ▶ **Commercialized recreation**
- ▶ **Emphasis on high degree of specialization**
- ▶
- ▶

Influence of technological change on society

- ▶
- ▶
- ▶ **Technological change has affected traditional family system in the following new changes:**

- ▶ **Emergence of nuclear family**
- ▶ **Women's involvement in male dominated area of work**
- ▶ **Change in standard of living**
- ▶ **New way of socialization of the children**
- ▶ **Change in orthodox values**
- ▶

Family system and technological change

Some demerits to the family system are:



Mechanical life-style

- ▶ **Formal type of relationships**
- ▶ **Change in existing social customs**
- ▶ **Less family ties between family members**



Some demerits brought by technological change to the family system are:

- ▶ **Some of the effects of technological change on religion are:**



Analysis of religious doctrines and traditions

- ▶ **The rigidity in caste system has been relaxed**
- ▶ **Men are free from religious rituals**
- ▶ **Religion has become the secondary thing not a primary one**



Religion and technological change

- ▶ **Some of the effects of technological change on rural life are:**
- ▶ **Migration towards urban areas**
- ▶ **Increase in consciousness of rural people**
- ▶ **Change in method of farming**
- ▶ **Life become comfortable than before**
- ▶ **Change in life pattern**
- ▶ **Urban life and technological change**

- ▶ **Some of the effects of technological change on urban life are:**
- ▶ **Shortage of land and houses**
- ▶ **Increase in slums**
- ▶ **Problem of transportation**
- ▶ **Increase in crimes**
- ▶ **Expensive life**
- ▶ **Money has become the most important thing**

Impact of computer on society

- ▶ **Social application: Solve human/ social problem such as**
 - **Medical diagnosis**
 - **Computer assisted instruction**
 - **Government program planning**
 - **Environmental quality control**
 - **Law enforcement**
- ▶ **Employment and productivity:**
 - **Increase in employment and productivity**
 - **Reduction in some type of job**
- ▶ **Impact on competition:**
 - **Allows large organisation to become more efficient or gain strategic competitive advantage**
 - **Small firms are driven out**

Impact of computer on society

▶ Impact on individuality:

- **Reduce human relationship**
- **Inflexible.**

▶ Impact on quality of life:

- **Production of better quality goods/services at low costs/effort/time**
- **Increase in leisure time**
- **Eliminated monotonous tasks (upgraded quality of life)**

▶ Impact on privacy:

- **Collect, store, integrate, interchange and retrieve-easy.**
- **Lost privacy**
- **Theft, crime**

- ▶ **The printing press is a mechanical device for printing multiple copies of a text on sheets of paper. Building on movable type which made its way to Europe from China in the 1300s, the use of movable type to mass produce printed works was popularized by a German goldsmith and eventual printer, Johannes Gutenberg, in the 1450s. While there are several local claims for the invention of the printing press in other parts of Europe, including Laurens Janszoon Coster in the Netherlands and Panfilo Castaldi in Italy, Gutenberg is credited by most scholars with its invention.**



- ▶ **Five hundred years ago when the printing press was invented there was a shift from laborious manuscript making to a print technology allowing large numbers of copies of written work to be created quickly, giving greater access to information and setting the stage for a slow but important transformation of societal literacy.**

- ▶ **Through the use of the printing press, literature became more commonplace than a rare commodity.**
- ▶ **More copies being circulated of books meant more readers and more exposure of writing style and technique.**
- ▶ **Writers become better at their craft through reading others and the accessibility made this possible.**
- ▶ **This made literature not only more common, but better. written material became available to the common people**
- ▶ **books could be mass produced**
- ▶ **newspapers could be produced in large numbers**
- ▶ **ideas/scientific knowledge could be easily communicated.**
- ▶ **copyright laws were passed helped standardise grammar/spelling**

- ▶ **Chinese Taoist alchemists were the major force behind the early invention of gunpowder. Emperor Wu Di (156-87 B.C.) of the Han dynasty financed research done by the alchemists on the secrets of eternal life. The alchemists experimented with the sulphur and saltpeter heating the substances in order to transform them. The alchemist Wei Boyang wrote the Book of the Kinship of the Three detailing the experiments made by the alchemists.**
- ▶ **During the 8th century Tang dynasty, sulphur and saltpeter were first combined with charcoal to create an explosive called huoyao or gunpowder. A substance that did not encourage eternal life, however, gunpowder was used to treat skin diseases and as a fumigant to kill insects before its advantage as a weapon was made clear.**

Gun powder

- ▶ **The Chinese began experimenting with the gunpowder filled tubes. At some point, they attached bamboo tubes to arrows and launched them with bows. Soon they discovered that these gunpowder tubes could launch themselves just by the power produced from the escaping gas. The true rocket was born.**



- ▶ ***Chemistry and society***
- ▶ **The name *organic chemistry* came from the word organism.**
- ▶ **Prior to 1828, all organic compounds had been obtained from organisms or their remains.**
- ▶ **The scientific philosophy back then was that the synthesis of organic compounds could only be produced within living matter while inorganic compounds were synthesized from non-living matter.**
- ▶ **A theory known as "*Vitalism*" stated that a "vital force" from living organisms was necessary to make an organic compound.**
- ▶ **1828, a German chemist Friedrich Wöhler (1800-1882) amazed the science community by using the inorganic compound ammonium cyanate, NH_4OCN to synthesize urea, H_2NCONH_2 , an organic substance found in the urine of many animals.**
- ▶ **This led to the disappearance of the "*Vitalism*" theory.**
- ▶

- ▶ ***Chemistry and society***
- ▶ **For the first two-thirds of the 20th century, chemistry was seen by many as the science of the future.**
- ▶ **The potential of chemical products for enriching society appeared to be unlimited.**
- ▶ **Increasingly, however, and especially in the public mind, the negative aspects of chemistry have come to the fore.**
- ▶ **Disposal of chemical by-products at waste-disposal sites of limited capacity has resulted in environmental and health problems of enormous concern.**
- ▶ **The legitimate use of drugs for the medically supervised treatment of diseases has been tainted by the growing misuse of mood-altering drugs.**

- ▶ **Mechanization or mechanisation is providing human operators with machinery to assist them with the physical requirements of work.**
- ▶ **It can also refer to the use of machines to replace manual labor or animals.**
- ▶ **A step beyond mechanization is automation.**
- ▶ **the term is most often used in industry.**
- ▶ **The addition of powered machine tools, such as the steam powered lathe dramatically reduced the amount of time needed to carry out various tasks, and improves productivity.**
- ▶ **Today very little construction of any sort is carried out with hand tools.**

▶

At the beginning of the 19th century, mechanization changed the world.

- ▶ **Now, it looks as if automation might have a similar impact on society.**
- ▶ **Automating difficult, hazardous, and tedious jobs makes a better work environment for humans.**
- ▶ **Robots are remarkable automation tools that have captured our imaginations.**



- ▶ **The invention of the steam engine at the end of the 18th century marked the advent of the Industrial Revolution.**
- ▶ **The social and economic impact of the Industrial Revolution on all countries that embraced it can hardly be overstated.**
- ▶ **Though individual strains quickly resulted and a host of new social problems, none can argue against the increased standard of living that resulted.**
- ▶ **There are those that argue the current expansion of automation and robotics will have an equally profound impact on our society.**

▶ **Machines have been enhancing human productivity throughout history, but it wasn't until the Industrial Revolution that mechanization escalated to alleviate drudgeries of manual labor and increase productivity across the board.**

- ▶ **Machines became the backbone of production and manufacturing, but human operators retained their essential role in controlling the machines.**
- ▶ **Slowly, technologies have been developed to reduce this dependence on human controllers.**
- ▶ **Pre-Industrial-Revolution controllers included water delivery controlled by clock type mechanisms and wind aims that kept windmills facing the dominant winds.**

- ▶ **"How have communications satellites changed the world?"**
- ▶ **The one sentence would be that communications satellites have drastically reduced the size of the world in that we can communicate with virtually anyone from anywhere at almost any time thanks to the communications satellites that are orbiting the Earth right now.**
- ▶ **Of course none of the satellites that are in orbit now would be successful if it wasn't for those that came before them and paved the way for them to come and for those in the future to come as well.**

- ▶ **One-to-one reciprocity.**
- ▶ **One-to-many and many-to-one**
- ▶ **Generalized reciprocity**
- ▶ **Plato's Crito, Socrates considers whether citizens might have a duty of gratitude to obey the laws of the state, in much the way they have duties of gratitude to their parents. Many other philosophers have considered similar questions.**
- ▶ **political philosophy, history of; for other traditions, Political philosophy in classical Islam;**
- ▶ **Political philosophy, Indian; African philosophy, Anglophone;**
- ▶ **Marxism, Chinese; Bushi philosophy; Shōtoku constitution; Sunzi; Marxist thought in Latin America.)**

Political and societal limitation

- ▶ **Economic analysis**
- ▶ **Legal analysis**
- ▶ **Philosophical analysis (ethics)**
- ▶ **Justice and happiness (Aristotle) (GOOD)**
- ▶ **Epicurus 3 century BC pleasure , healthy, friendship**
- ▶ **Buddha 500 BC**

- ▶ **No killing**

- No stealing**

- No sexual misconduct**

- No lying**

- No intoxicants**

- Respect for life**

- Respect for others' property**

- Respect for our pure nature**

- Respect for honesty**

- Respect for a clear mind**

Political and societal limitation

- ▶ **All human behavior is caused. People have a reason for doing whatever they do.**
All human behavior is directed toward achieving a goal. People do things to accomplish something. Their behavior is not random.
- ▶ **Each person is unique because of different heredity and environment. No two people are alike, so no two people have exactly the same characteristics.**
- ▶ **Most of the traditional theories research methodologies do not distinguish between different genders and cultures.**
Today at the time of increased globalization, lots of people seek employment in other countries and it seems that their prime motivator is higher wages, thus conclusions of some theories that money is not prime motivator is uncertain. (any comments)

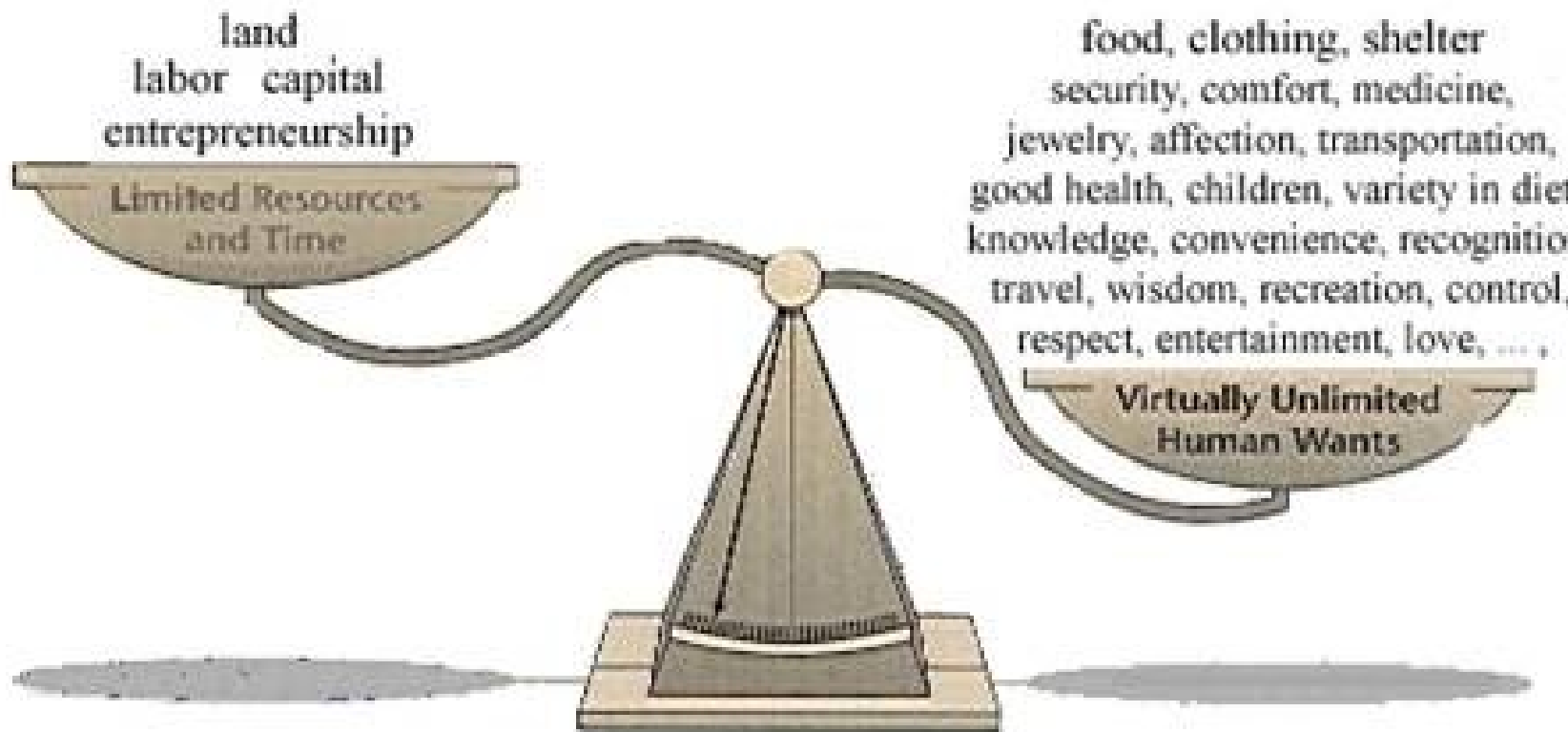
- ▶ **Economic problems emerge due to scarcity of resources.**
- ▶ **We do not get adequate resources from the nature to satisfy all our needs.**
- ▶ **Thus an economic man always chooses for which purposes the resources are to be utilised.**
- ▶ **Economics is the science of scarcity and it studies how the scarce resources are allocated in between different uses**
- ▶ **“Economics is the science which studies human behavior as a relationship between ends and scarce means which have alternative uses.”**
- ▶ **Wants are unlimited.**

- ▶ **No economic problem would have arisen if man's wants had been limited.**
- ▶ **But in the real life there is no end of wants.**
- ▶ **Wants come to half after the death of a man.**
- ▶ **Wants rise one after another.**
- ▶ **Wants differ in intensity.**
- ▶ **Some wants are more intense than others.**
- ▶ **As the wants differ in intensity, people allocate resources to maximise their want satisfaction.**
- ▶ **As against wants means to satisfy these wants are limited.**
- ▶ **Unlimited resources would pose no economic problem as all wants would have been satisfied with unlimited resources.**
- ▶ **Thus there would have been no problem of choosing between the wants and allocating resources between them.**

- ▶ **The resources refer to natural productive resources, man-made capital goods, consumer goods, time available with man etc.**
- ▶ **The scarce resources have alternative uses.**
- ▶ **The scan resources can be put into various uses. Monetary resources can either be utilised for the production of consumer goods or for the production of capital goods.**
- ▶ **The owner has to decide for which use resources should be allocated.**
- ▶ **If the resources would have single use only the question of choice would not have arisen.**
- ▶ **It is because of the alternative uses of resources we have to decide the best allocation of resources.**
- ▶ **With limited wants and unlimited resources a human being faces the problem of choice.**

- ▶ **The problem of choice arises due to the presence of limited resources and the resources are alternatively used.**
- ▶ **In the face of limited resources a man has to choose which want to satisfy first and which want to reject.**
- ▶ **He arranges different wants in order of their necessity for him.**
- ▶ **The most urgent wants are satisfied and the less urgent wants are postponed for future.**
- ▶ **The Professor Robbin remarks, when time and means for achieving ends are limited and capable of alternative application and the ends are capable of being distinguished in order of importance, then behavior necessarily assume the form of choice."**

SCARCITY



scarcity



Discussion



causes of international tensions



Drinking Water crisis

- ▶ **A comprehensive report by former World Bank chief economist Nicholas Stern undertaken on behalf of the UK government documents both the costs of climate change and of options for mitigation and adaptation.**
- ▶ **The Stern report estimates the cost of a changed climate could be from 5 percent to 20 percent of global GDP.**
- ▶ **Costs include those related to losses from declining agricultural production, heat-waves, droughts, flooding events, extreme precipitation, biodiversity loss, disease spread, and soil erosion.**
- ▶ **Conversely, the study estimates that a stabilization at 500-550 ppm CO₂equivalent (CO₂e, a measure of the contribution of six key greenhouse gases) will cost the global community roughly 1 percent of GDP by 2050.**

- ▶ **Necessary changes the power sector.**
- ▶ **Policies called for in the Stern report include a strong carbon signal through taxes, trading, or regulation, and research and development into low carbon-intensive technologies.**
- ▶ **In addition, Stern suggests that activities to curtail greenhouse gas emissions will be substantially more expensive if action is delayed rather than initiated in the near future:**
- ▶ **if we fail to act within the next decade or two, stabilization at 550 ppm CO₂e may be too challenging to achieve at all.**

- ▶ **, Hydrology Professor Uri Shamir once noted: ‘If there is a political will for peace, water will not be a hindrance. If you want reasons to fight, water will give you ample opportunities’**

- ▶ **Peace**
- ▶ **Conflict**
- ▶ **Climate change**
- ▶ **Food security**
- ▶ **Water**
- ▶ **Route**

- ▶ **Sustainable security focuses on the interconnected, long-term drivers of insecurity, including:**
- ▶ • **Climate change: loss of infrastructure, resource scarcity and the mass displacement of peoples, leading to civil unrest, intercommunal violence and international instability.**
- ▶ • **Competition over resources: competition for increasingly scarce resources – including food, water and energy – especially from unstable parts of the world.**
- ▶ • **Marginalisation of the majority world: increasing socio-economic divisions and the political, economic and cultural marginalisation of the vast majority of the world's population.**
- ▶ • **Global militarisation: the increased use of military force as a security measure and the further spread of military technologies (including chemical, biological, radiological and nuclear weapons).**

▶ **ENERGY PLANNING, POLICY AND ECONOMY; GENERAL AND MISCELLANEOUS//MATHEMATICS , COMPUTING, AND INFORMATION SCIENCE; HEALTH HAZARDS; RISK ASSESSMENT; OCCUPATIONAL SAFETY; REGULATIONS; COST BENEFIT ANALYSIS; DECISION MAKING; PRODUCTIVITY; HAZARDS; SAFETY**

Why engineering and safety?

- ▶ **Marginalisation is an issue both between and within nations, with income inequality labeled as a driver of insecurity a common thread, and inequality in power relations highlighted by the role of unelected forces e.g. the military.**
- ▶ • **Militarisation is an issue both at a local level (the availability of small arms and light weapons, particularly those with an entrenched and seemingly intractable culture of violence), and at a regional level e.g. arms race dynamics in Asia feeding insecurity.**
- ▶ • **Environmental issues (including climate change and competition over resources) will feed into water and food insecurity, and affect nations that rely on natural resources. Natural disasters will occur more often because of a changing climate, and this will place demands on some already fragile governments**

Cost– benefit and other risk acceptance studies are routinely conducted by the Nuclear Regulatory Commission, the Environmental Protection Agency, the Federal Aviation Administration, and other agencies. These studies are particularly useful for low probability-high consequence events where public safety is a key criterion for decision making. This includes the design and assessment of buildings, bridges, levees, and other infrastructure systems for protection against seismic, flood, hurricane and other natural hazards.

- ▶ **Since the events of SEP 11 there has been much focus on preventing or mitigating damage and casualties caused by terrorist activity. For example, since 2001 over \$300 billion has been spent**
- ▶ **by US government agencies on counterterrorism (CT) protective measures in the US homeland. Of this, approximately \$90 billion has been spent by the US government on protecting critical infrastructure and key resources**
- ▶ **A key issue is whether this CT expenditure has been invested in a manner that optimises public safety in a cost-effective manner.**
- ▶ **This is why the 9-11 Commission report, amongst others, called on the US government to implement security measures that reflect assessment of risks and cost effectiveness**

- ▶ **Technology advances risk are unavoidable**
- ▶ **Engineers are in social experimentation**
- ▶ **Multiple responsibilities**
- ▶ **Social benefit and risk**
- ▶ **risk/risk/**
- ▶ **Noun: A situation involving exposure to danger: "flouting the law was too much of a risk". Verb: Expose (someone or something valued) to danger, harm, or loss: "he risked his life to save his dog". Synonyms: *noun*. hazard - peril - jeopardy - danger - venture - chance**
- ▶ ***verb*. hazard - venture - jeopardize - adventure - chance**

▶

RISK ANALYSIS

- ▶ **Possible alternatives**
- ▶ **Specify objectives and measure the effect**
- ▶ **Identify consequences**
- ▶ **Quantify the alternatives**
- ▶ **Analyses the alternatives**

MANAGING RISK

Deal with uncertainties

Focus Specific classes of risk

Commitment to immediate solution

Inflexibility in risk analysis

**Risk management does not promote consensus,
collaboration cooperation**

- ▶
- ▶ **Cost / Benefit**
- ▶ **1. Define, or breakdown the plan / decision /process into its elements by drawing up a flowchart or list of inputs, outputs, activities and events.**
- ▶ **2. Calculate, research or estimate the cost and benefit associated with each element. (Include if possible direct, indirect, financial and social costs and benefits)**
- ▶ **3. Compare the sum of the costs with the sum of the benefits.**

- ▶
- ▶ **Benefit / Risk**
- ▶ **4. Rank the elements into a hierarchy that reflects their impact of their potential success / failure on the whole process. If the variation in the potential impact of the ranked elements is significant, then:**
- ▶ **5. Assign weighting values to each element.**
- ▶ **6. Estimate the likelihood of success or failure of each element.**
- ▶ **7. Multiply the likelihood of success or failure for each element by its weighting value.**
- ▶ **8. Compare the risk (result of 7) with the costs and benefits associated with (3).**

- ▶ **en·gi·neer·ing/ ,enjə'ni(ə)riNG/**
- ▶ **Noun: The branch of science and technology concerned with the design, building, and use of engines, machines, and structures.**
- ▶ **The work done by, or the occupation of, an engineer.**
- ▶ **Synonyms :technique - technics**

What is engineering

- ▶ **Engineering is the practical application of science and math to solve problems, and it is everywhere in the world around you.**
- ▶ **From the start to the end of each day, engineering technologies improve the ways that we communicate, work, travel, stay healthy, and entertain ourselves.**
- ▶ **Engineers are problem-solvers who want to make things work more efficiently and quickly and less expensively.**
- ▶ **From computer chips and satellites to medical devices and renewable energy technologies, engineering makes our modern life possible.**
- ▶ **In particular, engineers have a wide range of study options and career paths that let them design, build, and manage those ideas into reality.**

What is Engineering?

- ▶ **ed·u·ca·tion**
- ▶ **[ej-oo-key-shuhm] Show IPA**
- ▶ ***noun* 1. the act or process of imparting or acquiring general knowledge, developing the powers of reasoning and judgment, and generally of preparing oneself or others intellectually for mature life.**
- ▶ **2. the act or process of imparting or acquiring particular knowledge or skills, as for a profession.**
- ▶ **3. a degree, level, or kind of schooling: *a university education*.**
- ▶ **4. the result produced by instruction, training, or study: *to show one's education*.**
- ▶ **5. the science or art of teaching; pedagogics.**

what is education?

1. instruction, schooling, learning. EDUCATION, TRAINING imply a discipline and development by means of study and learning. EDUCATION is the development of the abilities of the mind (learning to know): *a liberal education*. TRAINING is practical education (learning to do) or practice, usually under supervision, in some art, trade, or profession: *training in art, teacher training*.

4. learning, knowledge, enlightenment. EDUCATION, CULTURE are often used interchangeably to mean the results of schooling. EDUCATION, however, suggests chiefly the information acquired. CULTURE is a mode of thought and feeling encouraged by education. It suggests an aspiration toward, and an appreciation of high intellectual and esthetic ideals: *The level of culture in a country depends upon the education of its people.*

Synonyms of education

- ▶ ***What Is Education?* is a profound philosophical exploration of how we transmit knowledge in human society and how we think about accomplishing that vital task.**
- ▶
- ▶ **Most contemporary approaches to education follow a strictly empirical track, aiming to discover pragmatic solutions for teachers and school administrators.**
- ▶ **Jackson argues that we need to learn not just how to improve on current practices but also how to think about what education means—in short, we need to answer Dewey by constantly rethinking education from the ground up. Guiding us through the many facets of Dewey's comments, Jackson also calls on Hegel, Kant, and Paul Tillich to shed light on how a society does, can, and should transmit truth and knowledge to successive generations.**
- ▶ **Teasing out the implications in these thinkers' works ultimately leads Jackson to the conclusion that education is at root a moral enterprise.**
- ▶

- ▶ **Beginning from the civilization**
- ▶ **Rome empire**
- ▶ **Babylonian**
- ▶ **Eastern civilization**
 - **Takshashila**
 - **Nalanda**
 - **Vikrmashila**
 - **Vishwakarma**
 - **Pathshala, gurukul etc**
- ▶ **Church, School, college, university**

- ▶ **Before the Industrial Revolution in the late 18th century, there were only two kinds of engineers:**
- ▶ **Military engineers – who built fortifications, catapults, and later, cannons**
- ▶ **Civil engineers – who built bridges, harbors, aqueducts, buildings and other structures**

- ▶ **Engineering is an incredibly broad field which involves the harnessing of mathematical and scientific concepts to create practical and useful things, ranging from automobiles to wind turbines. This field is huge, encompassing people in a wide range of industries, and some people call it “the invisible science,” because engineers are often unsung and unheralded, despite the fact that the work they do is very important. Many colleges and universities offer courses in engineering, for people who are interested in pursuing this field as a career.**
- ▶ **Engineering is a very ancient field of human endeavor. Early humans utilized their knowledge of the natural world to figure out things like irrigation schemes and how to build boats which didn't sink. Over time, as humans learned more about science and mathematics, engineering got more complex, and this field paved the way for the modern society we live in today. Chances are that you are benefiting from a product of engineering right now, as you are probably using a computer to read this article.**

- ▶ **There are a number of subfields encompassed by engineering. Among these are mechanical, computer, electrical, military, civil, environmental, aerospace, and chemical engineering. All of these fields require different types of training; aerospace engineers, for example, learn a great deal about physics and space in the course of their work, while environmental engineers consider issues like pollution control and the impact of humans on their environment.**

- ▶ **An engineering education is based on a strong foundation in math and science.**
- ▶ **Additional courses emphasize the application of this knowledge to a specific engineering field.**
- ▶ **Studies in the social sciences and the humanities give the engineer a broader education.**

What is engineering?

Engineering Technology Council of the American Society for Engineering Education.

- ▶ ***Engineering technology is the profession in which a knowledge of mathematics and natural sciences gained by higher education, experience, and practice is devoted primarily to the implementation and extension of existing technology for the benefit of humanity.***
- ▶ ***Engineering technology education focuses primarily on the applied aspects of science and engineering aimed at preparing graduates for practice in that portion of the technological spectrum closest to product improvement, manufacturing, construction, and engineering operational functions.***
- ▶ **Thus engineering technology is the application of engineering principles and modern technology to help solve or prevent technical problems.**

What is engineering?

- ▶ **Update and expand your technical skills and knowledge**
- ▶ **Understand and apply new technologies**
- ▶ **Solve on-the-job problems**
- ▶ **Network with your peers**

- ▶ **Industry expects an increasing shortage of high quality engineers over the next years.**
- ▶ **Industry and universities are in good agreement on the ways in which university engineering courses should be improved to provide graduates better motivated and attuned to the needs of industry and business.**
- ▶ **Research quality has benefited from the strong focus on research performance and increased funding for research.**
- ▶ **We must now turn that focus on teaching and make our learning and teaching approaches for engineering students fit for 21st Century 'learners' and able to deliver the knowledge and skills industry needs.**
- ▶ **This requires increased funding for engineering courses and an increase in the perceived status of and reward for innovative teaching in our strongest universities.**

- ▶
▶ **Ethics,**
▶ **environment,**
▶ **equality,**
▶ **sustainability etc**



