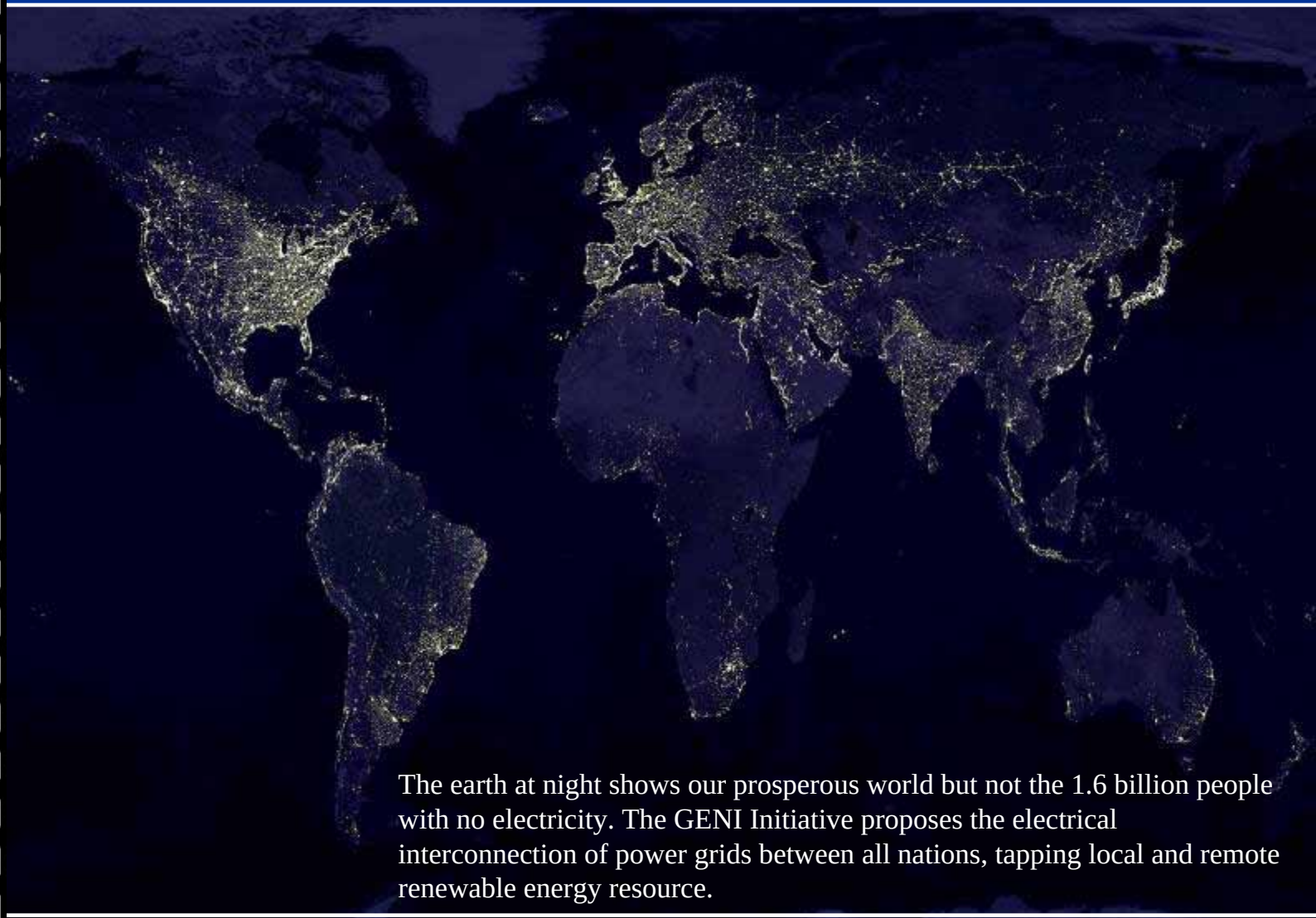
What is electricity?
Population & Energy
Buckminster Fuller & Dymaxion Map
Energy Grid
Renewable Energies
Benefits & Endorsements

A GLOBAL SOLUTION



The earth at night shows our prosperous world but not the 1.6 billion people with no electricity. The GENI Initiative proposes the electrical interconnection of power grids between all nations, tapping local and remote renewable energy resource.

GENI
What is GENI?
www.geni.org
EXIT

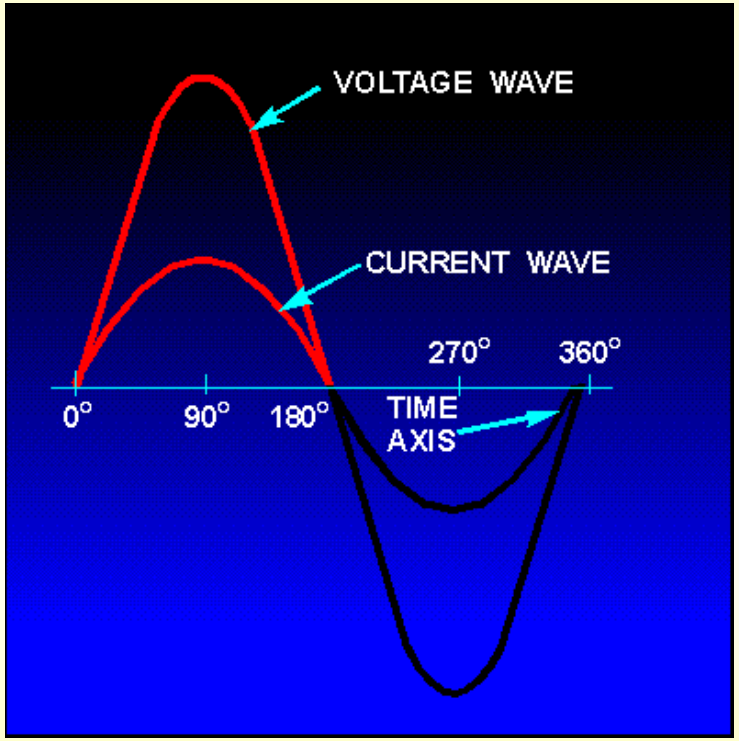
Electricity

Electricity Moves at the Speed of Light

Electricity is Either “ON” or “OFF”

You Can’t Store Electrical Energy

Demand for Power Varies from Day to Night



Electricity Moves at the Speed of Light

Electricity is not like other products - it is a real time commodity. An electrical wave transmits at the speed of light: 186,000 miles per second (300,000 kilometers per second). If a circuit bridled the equator the electrical wave would circle the earth 7.5 times in one second. Electrical energy is generated, transmitted and used virtually in the same instant.

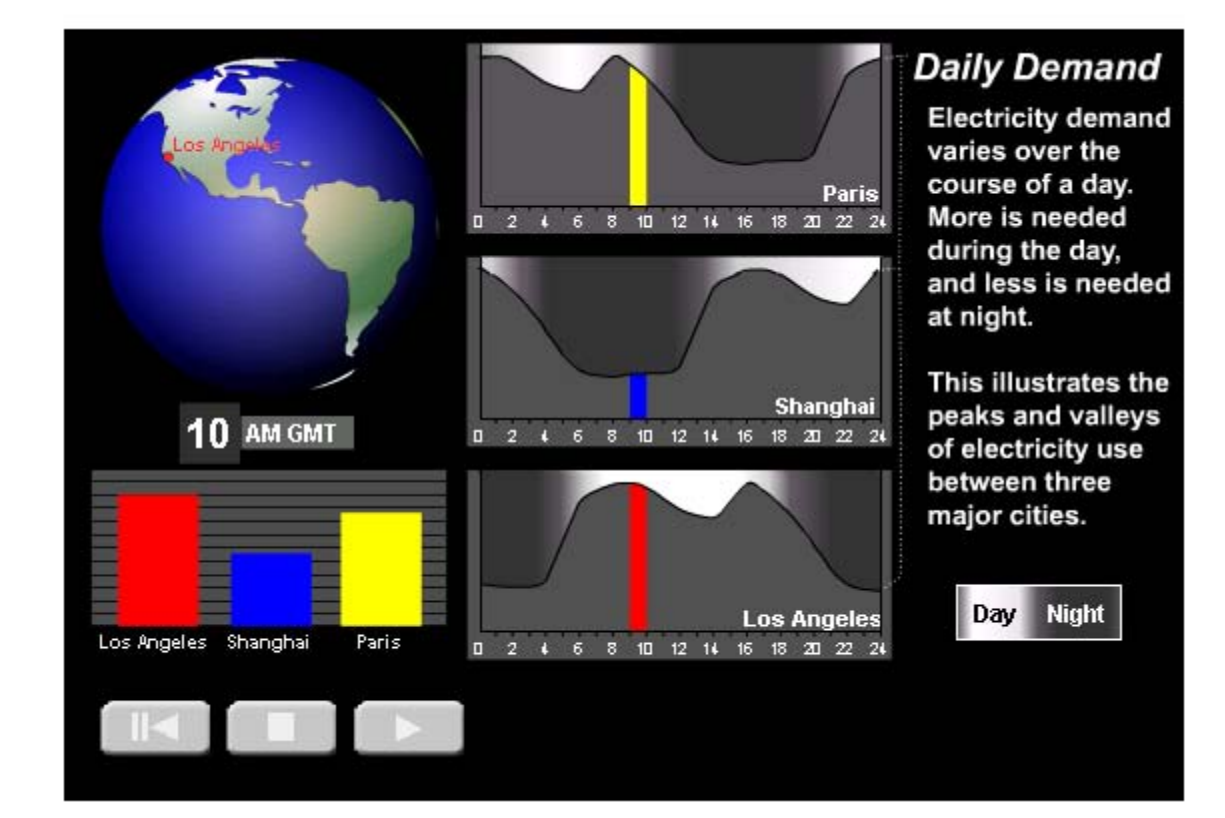
Electricity is Either “On” or “Off”

Electricity is essentially used at the same moment it is generated. Power generators, like an on/off switch, are either connected to the electricity (at 60 cycles per second in most nations), or they are off-line in a stand-by mode or powered down.

You Can't Store Electrical Energy

We do have batteries that store chemical energy to start our cars and power small needs. However, the electricity needed for industry and cities is too great to be stored in any battery. Therefore, we must generate sufficient megawatts at every moment, plus some excess for reserve - or face straining the system into a blackout.

Demand for Power Varies from Day to Night



Population & Energy

Regional Population 1950 - 2015

Growth in Mega Cities

Wealth Distribution

World Premier Energy Supply by Fuel

Per Capita CO2 Emission by Region

The World Energy Council Renewable Intensive Scenario

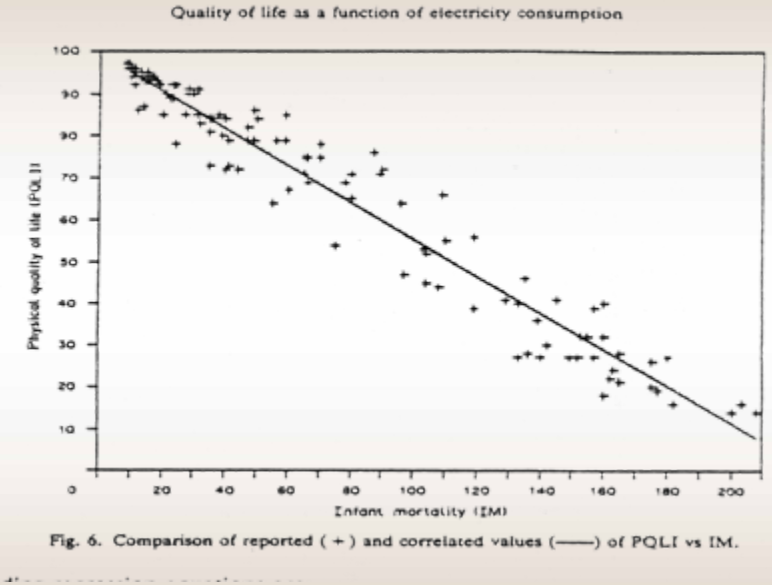
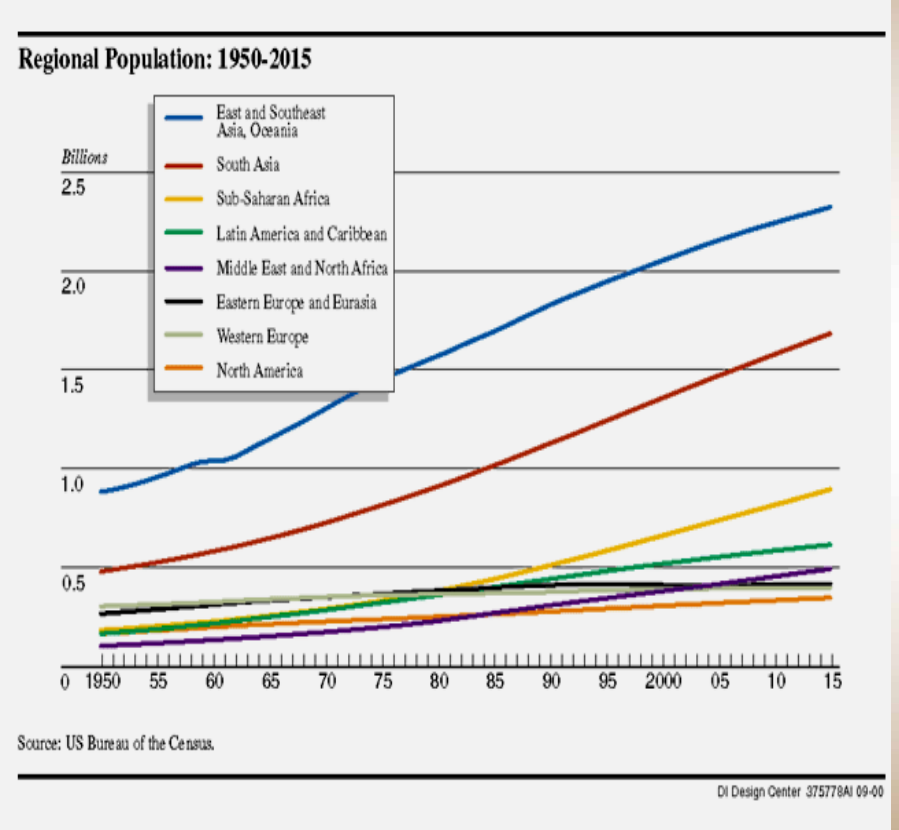


Fig. 6. Comparison of reported (+) and correlated values (——) of PQLI vs IM.

Population & Energy

Regional Population 1950-2015

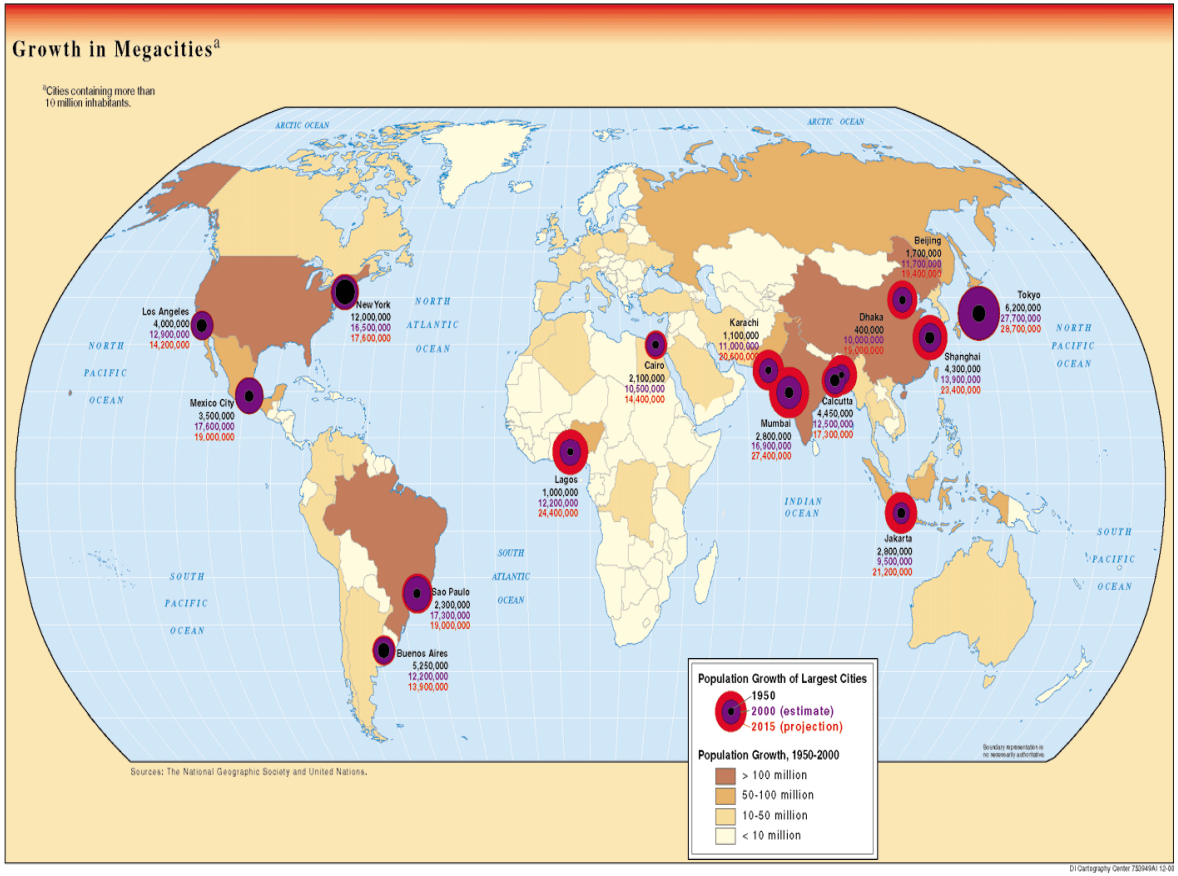
Population growth rates may vary widely between regions. When they reach replacement levels, developed regions trend upwards from increased longevity and immigration. The population momentum of China, India and Southeast Asia and Africa is what drives global resource use concerns. Half the global population currently lives in East, Southeast or South Asia. High growth rates usually correlate with high infant morality rates in those regions.



Population & Energy

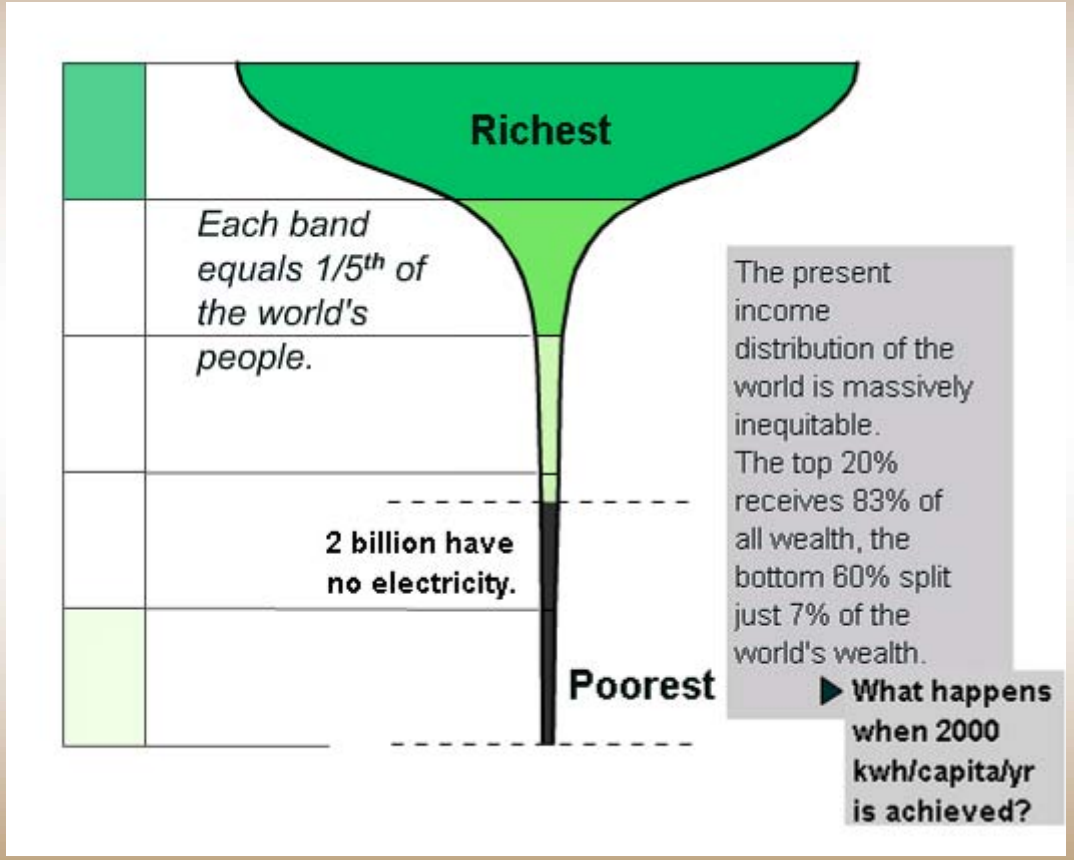
Growth in Mega Cities

Cities with very large populations create tremendous pressure on the infrastructure of the region; water, sewer, power, transportation, shelter and communication. The urban growth in the Latin America, South Asia and Africa will stress these services further if the projections are accurate in the coming years.



Population & Energy

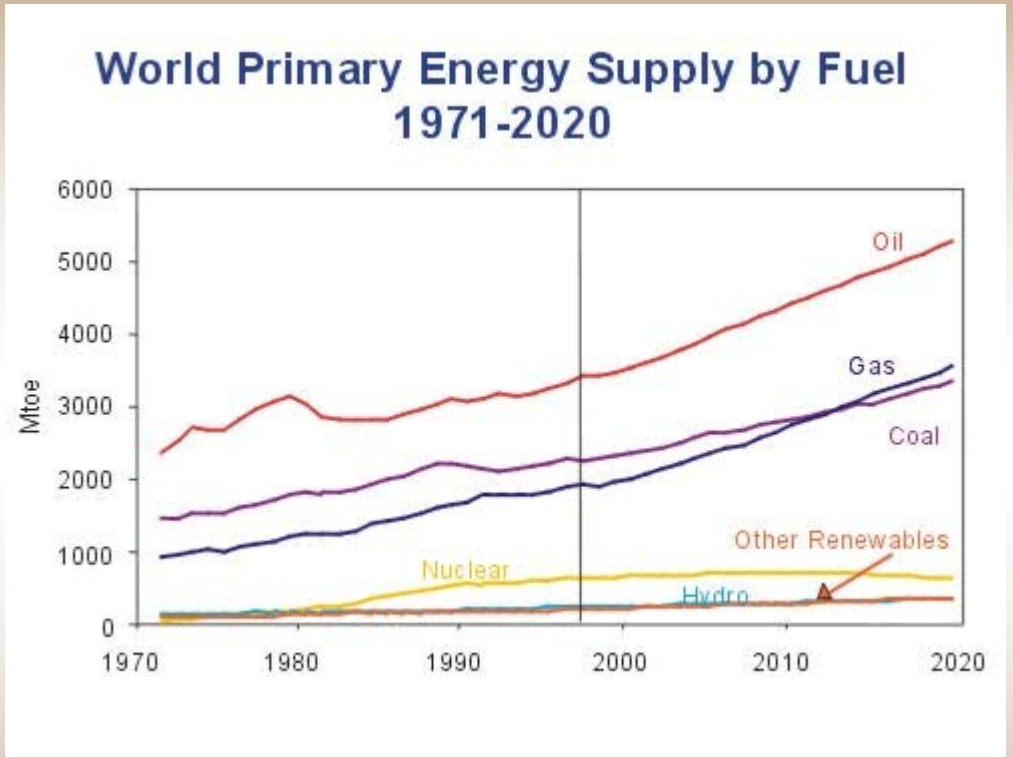
Wealth Distribution



Population & Energy

World Primary Energy Supply by Fuel

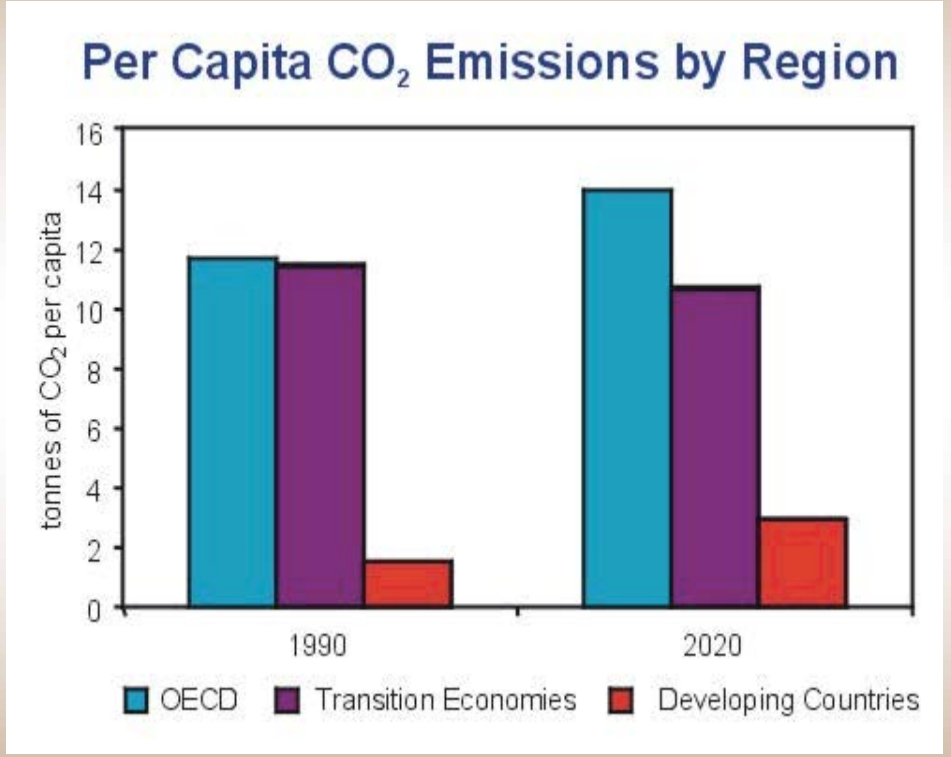
The International Energy Agency projects continued growth in all dominant fossil fuels for the near future. Renewable energy will slowly expand while there is a resurgence of interest in nuclear development.



Population & Energy

Per Capita CO_2 Emissions by Region

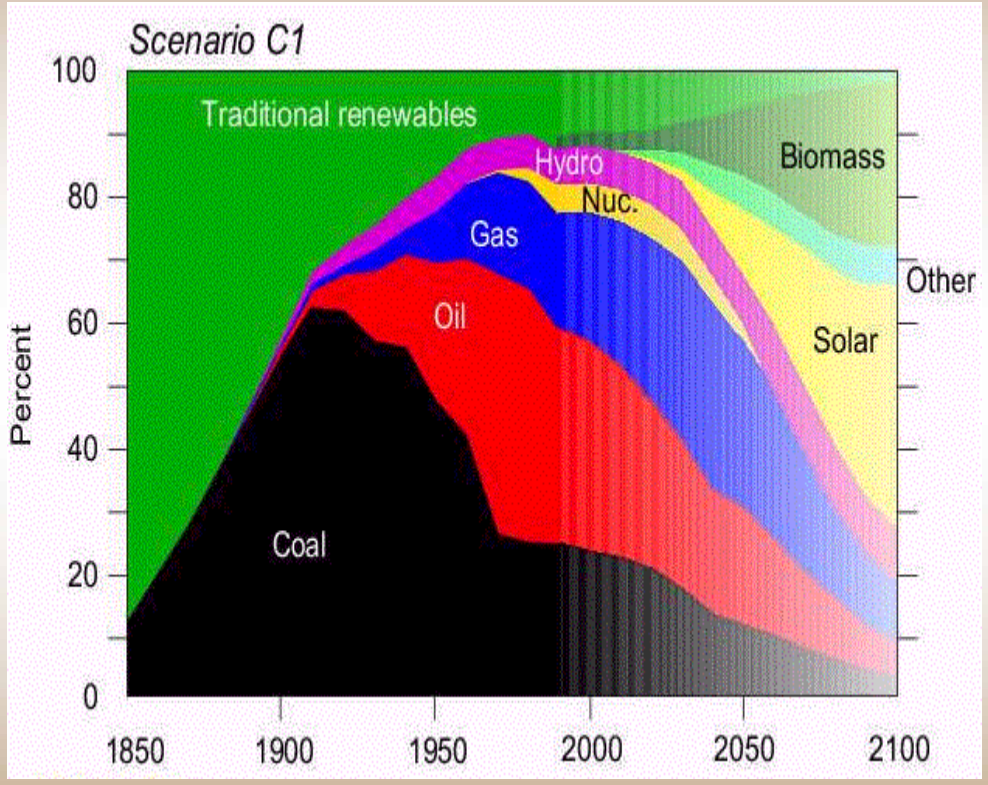
Historically, the emission of carbon dioxide traces the development of modern economies. Fossil fuels (coal, oil and natural gas) power the factories, electricity generation and automobiles in our society. Even then the developing economies are projecting strong fossil fuel growth, any real reduction in green house gases must come from OECD (Org for Economic Cooperation & Development) and Transition (former communist) economies.



Population & Energy

The World Energy Council Renewable Intensive Scenario

This scenario offers a renewable intensive path that projects a phasing out of nuclear power by 2050. By 2100, this scenario reduces fossil fuels to just 20% and renewable providing 80% of all energy needs. Solar grows to provide 1/3 of the market.



Main menu

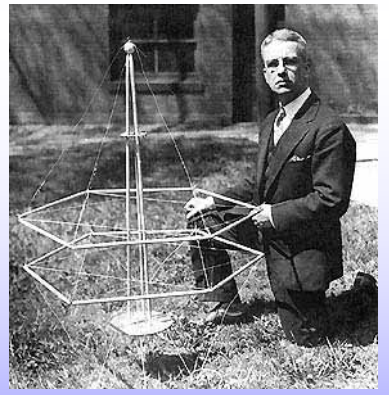
Buckminster Fuller & Dymaxion Map

Who is Buckminster Fuller?

The Dymaxion Map

The World Game

Buckminster Fuller on the Global Energy Grid

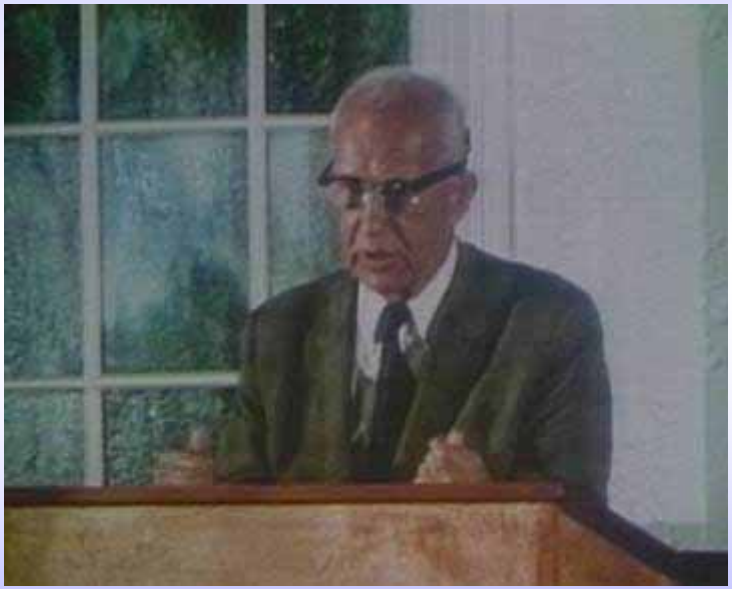


GENI

Buckminster Fuller & Dymaxion Map

Who is Buckminster Fuller?

“For the first time in history it is now possible to take care of everybody at a higher standard of living than any have ever known. Only ten years ago the ‘more with less’ technology reached the point where this could be done. All humanity now has the option to become enduringly successful”.



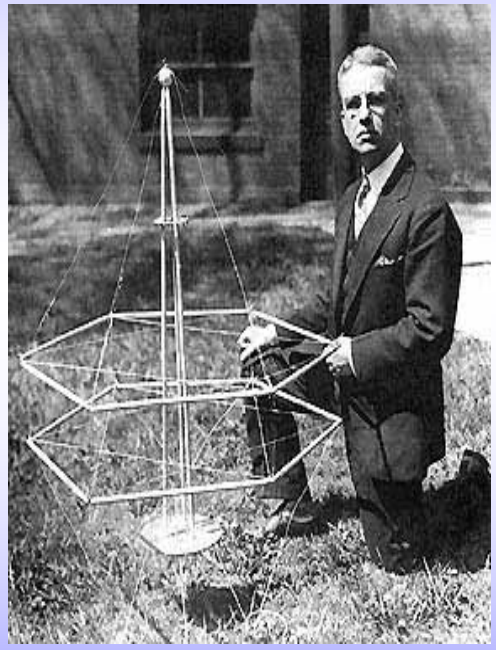
This confident assertion was made in 1980 by the late R. Buckminster Fuller- inventor, architect, engineer, mathematician, poet and cosmologist. Bucky, as he preferred to be called, was truly a man ahead of his time. His lifelong goal was the development of what he called “Comprehensive Anticipatory Design Sciences”- the attempt to anticipate and solve humanity’s major problems through the highest technology by providing “more and more life support for everybody, with less and less resources.”

Fuller was a practical man who demonstrated his ideas as inventions that he called “artifacts.” Some were built as prototypes; others exist only on paper; all, he felt ,were technically viable. He was a dogged individualist whose genius was felt throughout the world for nearly half a century. Even Albert Einstein was prompted to say to him, “Young man, you amaze me.”

Buckminster Fuller & Dymaxion Map

Who is Buckminster Fuller?

In 1927, at the age of 32, Buckminster Fuller stood on the shores of Lake Michigan, prepared to throw himself into the freezing waters. His first child had died. He was bankrupt, discredited and jobless, and he had a wife and new-born daughter. On the verge of suicide, it suddenly struck him that his life belonged, not to himself, but to the universe. He chose at that moment to embark on what he called "an experiment to discover what the little, penniless, unknown individual might be able to do effectively on behalf of all humanity." Over the next fifty-four years, he proved, time and again, that his most controversial ideas were practical and workable.



During the course of his remarkable experiment he:

- **was awarded 25 U.S. patents**
- **authored 28 books**
- **received 47 honorary doctorates in the arts, science, engineering and the humanities**
- **received dozens of major architectural and design awards including, among many others, the Gold Medal of the American Institute of Architects and the Gold Medal of the Royal Institute of British Architects**
- **created work which found itself into the permanent collections of museums around the world**
- **circled the globe 57 times, reaching millions through his public lectures and interviews.**

Buckminster Fuller & Dymaxion Map

Who is Buckminster Fuller?

Buckminster Fuller is best known for the invention of the geodesic dome–the lightest, strongest, and most cost-effective structure ever devised. The geodesic dome is able to cover more space without internal supports than any other enclosure. It becomes proportionally lighter and stronger the larger it is. The geodesic dome is a breakthrough in shelter, not only in cost-effectiveness, but in ease of construction.

Fuller was one of the earliest proponents of renewable energy sources – solar, wind and wave) – which he incorporated into his designs. He claimed, "there is no energy crisis, only a crisis of ignorance." His research demonstrated that humanity could satisfy 100% of its energy needs while phasing out fossil fuels and atomic energy. For example, he showed that a wind generator fitted to every high-voltage transmission tower in the U.S. would generate three-and-a-half times the country's total recent power output.

Fuller originated the term "Spaceship Earth." His Dymaxion™ Map was awarded the first patent for a cartographic system and was the first to show continents on a flat surface without visible distortion, appearing as a one-world island in a one-world ocean.

Buckminster Fuller & Dymaxion Map

Who is Buckminster Fuller?

His World Game® utilizes a large-scale Dymaxion Map for displaying world resources and allows players to strategize solutions to global problems, matching human needs with resources. His Inventory of World Resources, Human Trends and Needs was created to serve as an information bank for the World Game.

In some ways, Fuller's most significant artifact is the extensive personal archives that he maintained throughout his life. Buckminster Fuller died in July, 1983, leaving behind him a thoroughly documented 56-year experiment – a testament to the effectiveness of individual initiative.

Buckminster Fuller & Dymaxion Map

The Dymaxion Map explained

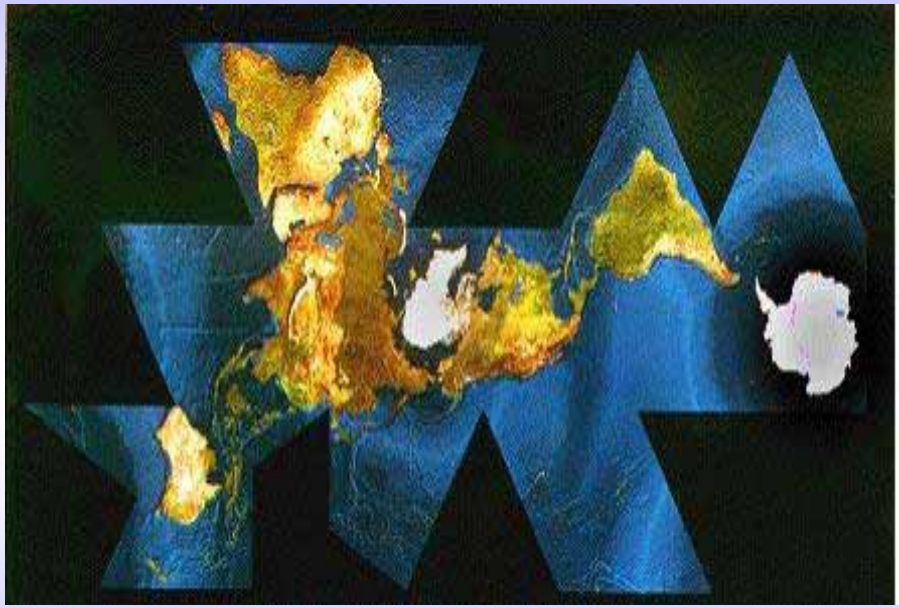
THE MOST ACCURATE FLAT MAP OF THE EARTH

The Dymaxion Map is the only flat map of the entire surface of the earth that reveals our planet as it really is -- a one-world island in one-world ocean without any visible distortion of the relative shapes and sizes of the land areas, and without splitting any continents.

The maps commonly in use today, exaggerate and divide the land masses in their attempt to show the curved surface of the earth as a flat projection.

Greenland appears as a large or larger than the US and Australia, although it is actually much smaller. The massive continent of Asia usually does not fit unless divided.

He developed a powerful tool that could allow viewers to study; “at a glance, the total synergetic significance of AirOcean economies and the alternate strategies for integrating all phases and states of energy resources towards the highest operative advantage of all world people”.



Buckminster Fuller & Dymaxion Map

The World Game

The purpose of the World Game is

"to make the world work for 100% of humanity in the shortest possible time through spontaneous cooperation without ecological damage or disadvantage to anyone".

"Walking around on the Dymaxion "Big Map" of Buckminster Fuller is the best experience of Earth I've had since returning from the moon".

Buzz Aldrin, Astronaut

Buckminster Fuller & Dymaxion Map

The World Game

The World Game™ is a multi-media event. Participants become the world's leaders, regional citizens, news reporters, business moguls and representatives of international organizations such as the World Bank and United Nations. Armed with the latest data, and equipped with food, natural resources, money, energy, technology and military expenditures as they are distributed in the world today, players stand on the most accurate map of the world, Buckminster Fuller's Dymaxion Map (the size of a basketball court). Left to negotiate with neighboring and far away nations to find global solutions for local problems, participants are quickly engaged in a fast-moving interactive simulation, where global problems are identified, addressed and solved, leaving the player with a new understanding of world issues.

The goals of the 4-hour experience are:

- **To increase the universal living standard**
- **To reduce pollution from fossil fuel and nuclear fuels**
- **To reduce poverty and world hunger**
- **To stabilize population growth**
- **To increase international trade, cooperation and world peace**

"The World Game highlighted the issue of achieving win-win situations throughout the world as opposed to specific win-lose situations or regional solutions."

GM Executive

Buckminster Fuller & Dymaxion Map

Buckminster Fuller on the Global Energy Grid

"Graphs of each of the world's 150 nations show their twentieth century histories of innate energy production per capita for their respective populations together with graphs of those countries' birthrate decrease at exactly the same rate that the per capita consumption of electrical energy increases. The world's population will stop increasing when and if the integrated world electrical energy grid is realized. The grid is the World Game's highest priority objective."

Critical Path, 1981, Fuller and Kuromiya

"I have summarized my discovery of the option of humanity to become omnieconomically and sustainably successful on our planet while phasing out forever all use of fossil fuels and atomic energy generation other than the sun. I have presented my plan for using our increasing technical ability to construct high voltage, superconductive transmission lines and implement an around-the-world electrical energy grid integrating the daytime and nighttime hemispheres, thus swiftly increasing the operating capacity of the world electrical energy system and concomitantly, living standard in an unprecedented feat of international cooperation.

Cosmography, 1993, Fuller and Kuromiya

"Because energy is wealth, the integrating world industrial networks promise ultimate access of all humanity everywhere to the total operation commonwealth of the earth".

Utopia or Oblivion, 1969, Fuller

Buckminster Fuller & Dymaxion Map

Buckminster Fuller on the Global Energy Grid

When Buckminster Fuller was asked by a 12 year old boy, "How would you suggest solving international problems without violence? " he answered: "I always try to solve problems by some artifacts, some tools or invention that makes this particular kind of problem no longer relevant. My answer would be to develop a world energy grid, an electric grid where everybody is on the same grid.

All of a sudden there would be no problems any more, no international troubles. Our new economic basis wouldn't be gold or dollars; it would be kilowatt hours."

Fuller's Earth, 1983, Richard Brenneman

This now feasible, intercontinental network would integrate America, Asia and Europe, and integrate the night-and-day, spherically shadow-and-light zone of Planet Earth. And this would occasion of 24-hour use of the now only fifty percent of the time used world-around standby generator capacity, whose fifty percent unused capacities heretofore were mandatorily required only for peakload servicing of local non-interconnected energy users. Such intercontinental network integration would overnight double the already-installed and in-use, electric power generating capacity of our Planet."

Telegram to Senator Edmund Muskie, Earth, Inc., 1973, Fuller

Main menu

Energy Grids

Selected regional energy grids:

UCTE (Union for the Coordination of Transmission of Electricity)

SADC (South African Development Council)

BALTREL (Baltic Ring Electricity Co-operation)

SIEPAC (Central American Power Grid)

APREC (Asia Pacific Rim Electricity Cooperation

Gulf States Cooperation Council

United States Interconnected Grid

GENI

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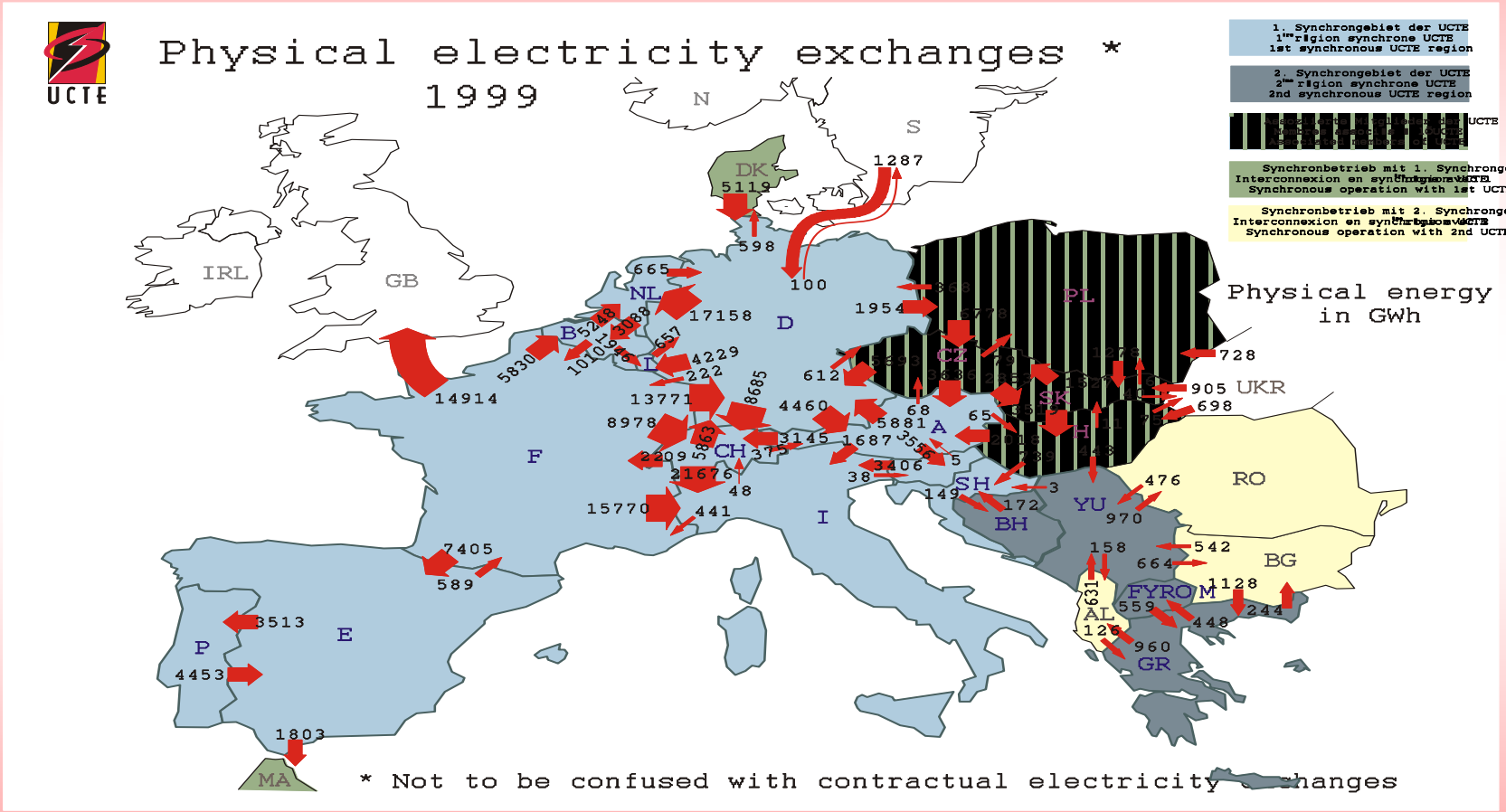
Energy Grids

UCTE (Union for the Coordination of Transmission of Electricity)



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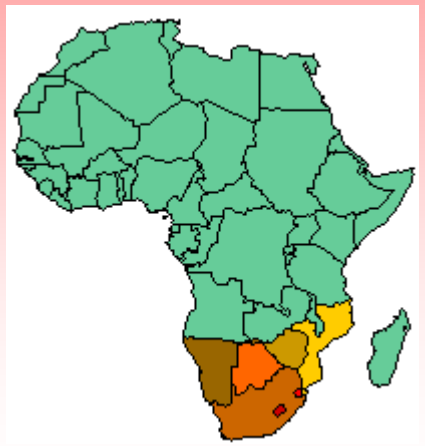
EXIT

Energy Grids

SADC (South African Development Council)

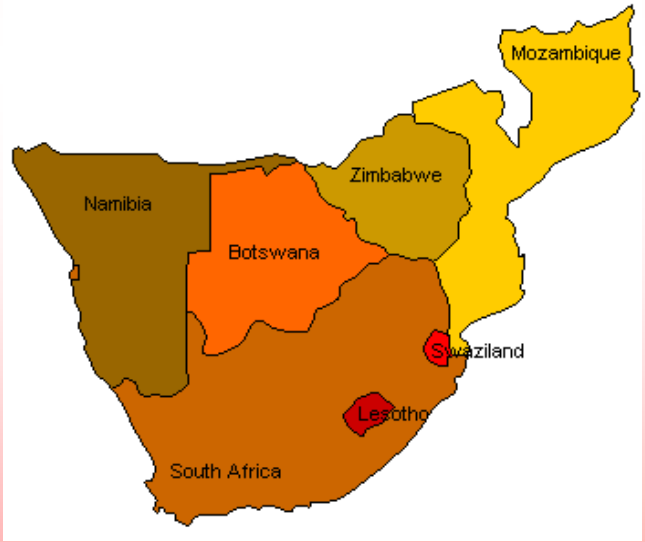
Co-operation between the EU and Southern Africa to Promote Renewable Energy

There are 7 Southern African countries involved in the SAREIN project. Each country has their own national Renewable Energy Information Network (REIN), lead by a SAREIN Network Partner.



The seven member countries' national Renewable Energy Information Networks are:

Botswana - REINBO
Lesotho - REINLES
Mozambique - REINMOZ
Namibia - REINNAM
South Africa - REINSA
Swaziland - REINSWA
Zimbabwe – REINZIM



ETSU and BCEOM are the European consortium, acting for the European Commission. Please click on the logo for details of their involvement in SAREIN. The EU Co-ordinator and Project Manager is Mr. Andrew Lamb

BALTREL (Baltic Ring Electricity Cooperation)

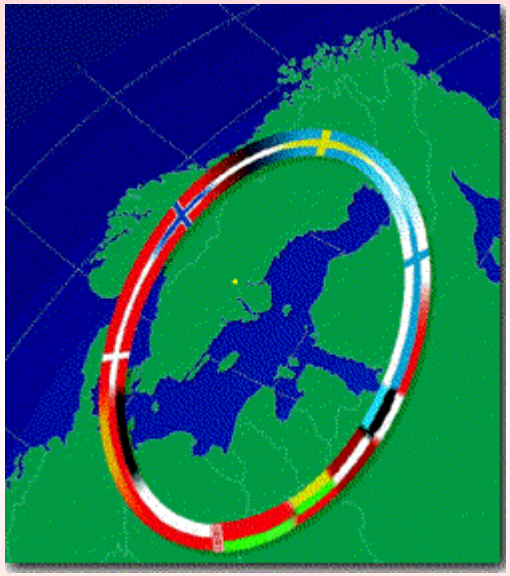
Baltic Ring Study - Executive Summary (Doc DK - 98/60)

The Baltic Ring Report- conclusions from the work towards a common Baltic electricity market.

• An effective and reliable energy supply is an important condition for economic growth and environmentally sustainable development. The European Union has given priority to the development of a common Baltic electricity market as one of the major Transeuropean Networks.

• This Baltic Ring report is the result of a co-operation between 18 power companies and utility organizations. The conclusion of the study has been going on for 2 years and were presented in Riga January, 1998.

• The project group has collected extensive data on the plans of production, transmission and other important energy issues describing the benefits of energy integration in the Baltic Region.



BALTREL (Baltic Ring Electricity Cooperation)

General findings

- **The Baltic Ring report identifies many advantages of a common electricity market. Higher stability and possibilities of reducing emissions through common environmental standards create extensive benefits for the region as a whole. In economic terms, a common market can lead to lower running costs and reduced investment needs.**
- **Before these possibilities can be fully utilized, however, a number of changes are needed. To avoid "environmental dumping" and give all players equal conditions on the market, environmental and trading rules need to be harmonized. The integration should be driven by market forces and socio-economic aspects and not solely by and electricity demand.**
- **The environmental aspect need to be developed further through Activities Implemented Jointly. This would take the establishment of a legal and financial framework which allows for environmental investments, such as the renewal of power plants in the region.**
- **Combined Heat and Power plants are especially suitable for combining environmental sustainability with an effective and reliable energy supply.**

Energy Grids

SIEPAC (Central American Power Grid)

Complementary Feasibility Studies and Support for the Central American Power Grid

GENERAL DESCRIPTION:

The objective of this nonreimburseable technical cooperation is to carry out the complementary feasibility studies needed to determine the best interconnection alternative for the Central American power grid. It will include technical, economic, institutional and environmental evaluations, as well as a decision on the form of ownership for the project.

This technical cooperation will support the following activities: (a) preparation of technical and economic feasibility studies, including environmental assessment, and preliminary design work for the project; (b) examination of legal regulatory and institutional conditions and the barriers to a regional energy exchange market;

SIEPAC (Central American Power Grid)

(c) definition of national concessions and institutional arrangements, including the regional legislative and regulatory framework, the company that will operate and own the system, and the financial impact on companies in the region; (d) publicity campaigns and seminars concerning the project; and (e) financing for part of the operating costs of the projects Executive Secretariat.

CONSULTANTS:

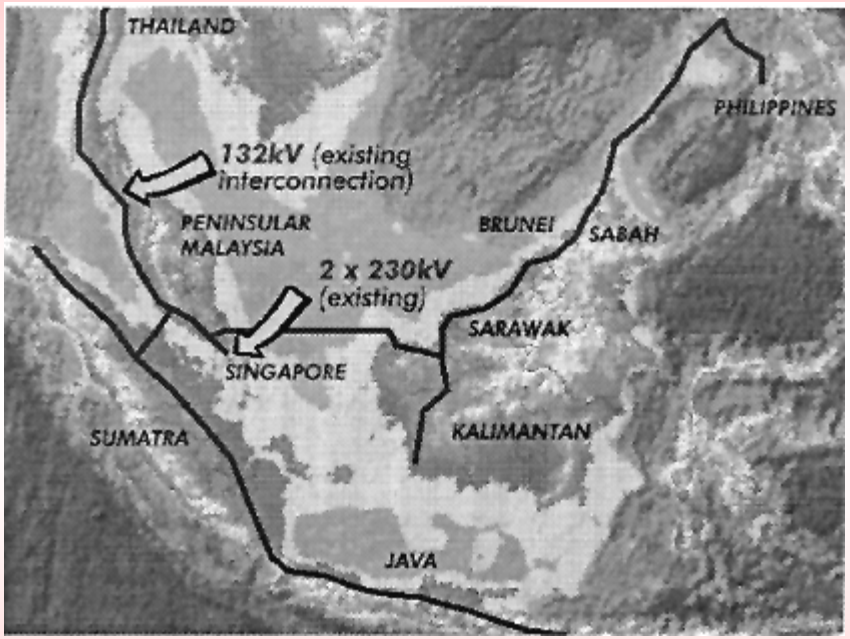
Two international consulting firms (Institute de Investigaciones Tecnologicas of Madrid University and the U.S. consulting firm Power Technologies, Inc.) specialized in technical and economic studies for expanding electricity generation, transmission systems and international power grids, have been hired to prepare and update least-cost expansion plans, prepare electric power and reliability studies, review costs and benefits for the region by country and conduct an economic evaluation of the project, identifying the investment strategy that will maximize net economic benefits.

APREC (Asia Pacific Rim Electricity Cooperation)

Expanding Electricity Trade

"It is surprising for us living in the Islands of Japan to discover that electricity trade is expanding worldwide. Last year, our study mission on Asian energy visited countries where rapid economic growth exploded the demand for electricity beyond existing capacity. These countries were seeking Independent Power Producers or Electricity imports. This year's second mission visited countries with hydropower potential. We also witnessed clearly the emergence of electricity trade.

Although the present status of electricity trade is small, some governments signed a Memorandum of Understanding. In ASEAN, there is the Power Utility Forum. Within this forum, study groups plan the future ASEAN power system. Figure 2 shows interconnection of the future ASEAN power system."

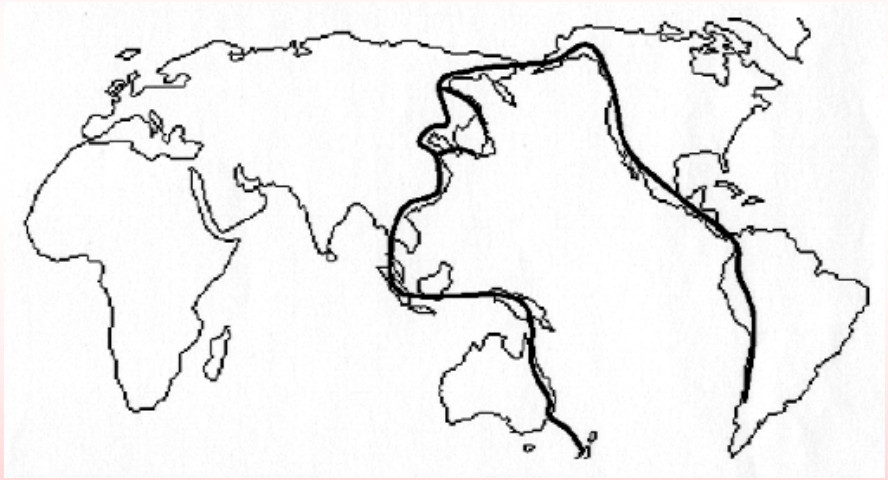


APREC (Asia Pacific Rim Electricity Cooperation)

International Cooperation

To pursue this kind of vision, the most important thing is international cooperation. With the leadership of international organization such as APEC and ADB, with all might and main of governments and private companies and non profit organizations, we can realize this trans-border power network, a favorable step towards global ecology.

Asian nations used to achieve high economic growth, but now they have suffered due to a financial crisis. Further, the prolonged slowdown of the Japanese economy threatens to become increasingly serious. To escape from this stagnation, the Asia Pacific rim can pull the world economy like a locomotive, an important role in the 21st century that can be realized by the APREC vision.



Energy Grids

Gulf States Cooperation Council

Middle East Grid Connection- the key to cooperation

For years, Arab countries' economic collaboration was to be found more in the realm of the rhetoric than reality. Now, in the field of electric supply, concrete steps are finally being taken. Throughout the Middle East, schemes are in hand to link national electricity grids. When completed in the coming decade, an unbroken supply system will be functioning from the Arabian Gulf to the Atlantic and from the Mediterranean to the Arctic Ocean.

The most developed scheme is a project to link Egypt, Jordan, Syria, Turkey and Iraq. One of the biggest schemes- albeit the slowest moving - is an estimated $6 billion project to link the grids of the six member states of the Gulf Cooperation Council - Saudi Arabia, Kuwait, Qatar, Bahrain, the United Arab Emirates and Oman.

GENI

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EXIT

Gulf States Cooperation Council

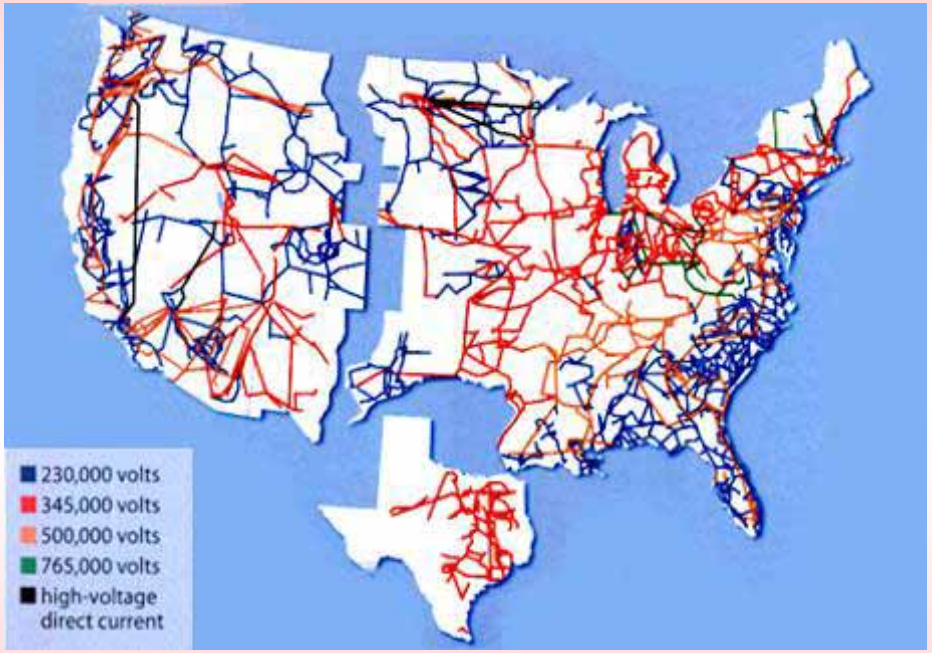
Needs for Cooperation

Faced by spiraling power demand and tight budgets stemming from oil price uncertainty, governments throughout the region are realizing that practical collaboration is infinitely more beneficial - and profitable - than lip- service to abstract ideals of regional fraternity. And economic integration both requires and encourages political harmony - an especially valuable prize for this, of all regions.

United States Interconnected Grid

“Another interesting opportunity for Mexico is to expand the capacity to export electricity in the western part of Mexico up into California, to supplement the California energy market. There is some energy being exported north now. It’s a choice for Mexico and for the United States to cooperate to develop the interconnections necessary to move power across our border.”

President George W. Bush



Main menu

Renewable Energies

Hydropower

Wind

Geothermal

Biomass

Solar

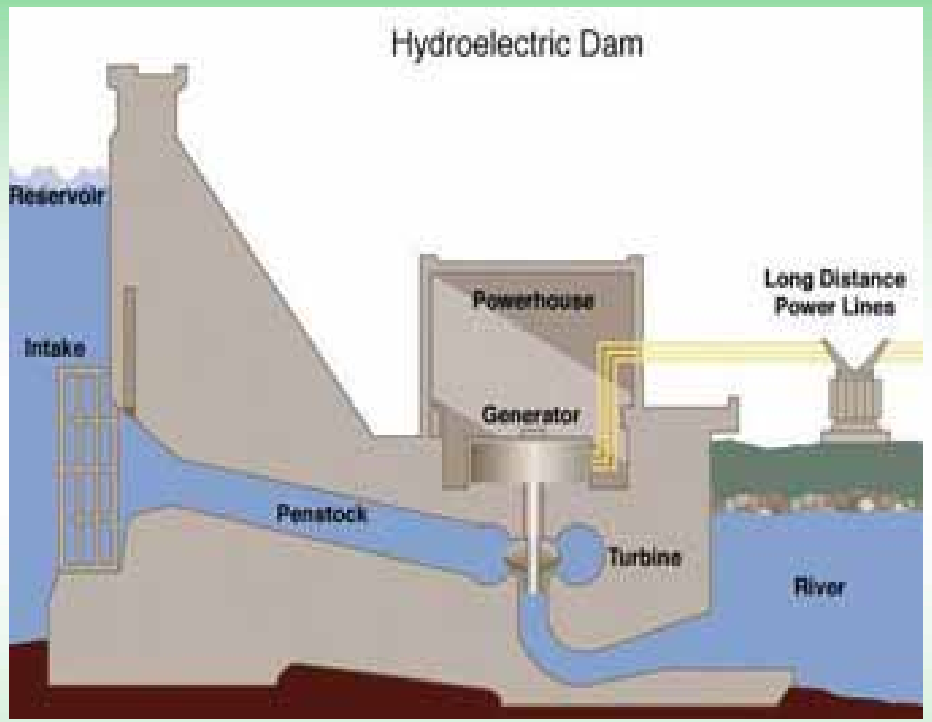
Tidal

Hydropower

Present role of hydro in the world

First, it is important in a debate on dams to point out that hydropower stations are, in fact, only incorporated at about 20-30 per cent of dams higher than 15 m, and often hydropower is not the primary function.

70 per cent of the world's dams are built specifically for irrigation or water supply, and many of the others have one of these roles as their principal function.



Renewable Energies

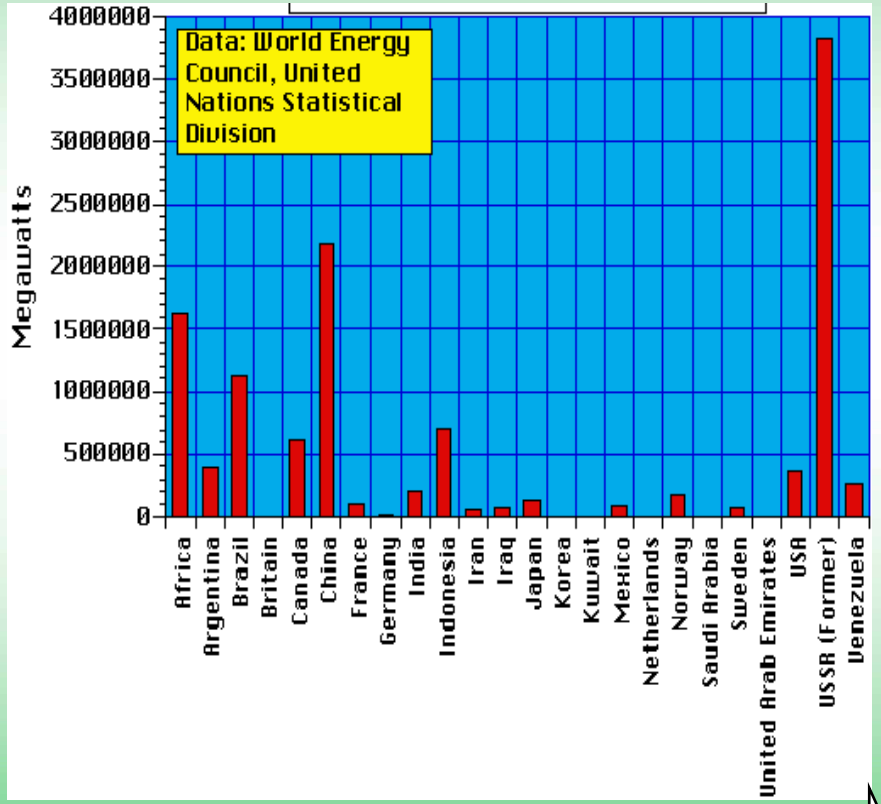
Hydropower

Hydro potential

The world's total technically feasible hydro potential is estimated at 14320 TWh/year, of which about 8100 TWh/year is currently considered economically feasible for development. About 700 GW (or about 2600 TWh/year) is already in operation, with a further 108 GW under construction. Most of the remaining potential is in Africa, Asia and Latin America.

Hydropower at present supplies about 20 percent of the world's electricity. If all of the economically feasible potential were to be developed, and it substituted fossil fuelled thermal plants, global CO_2 production could be reduced by between 4700 to 7000 million tons a year.

The graph below describes potential hydroelectric capacity of some selected nations. Areas of the world rich in hydroelectric power generation potential include: Africa, Brazil, Canada, China, Indonesia, and the former USSR.



Hydropower

Main Characteristic of hydropower

Its resources are widely spread around the world. Potential exists in about 150 countries, and about 70 percent of the economically feasible potential remains to be developed. This is mostly in developing countries.

It is a proven and well advanced technology (with more than a century of experience), and modern power plants provides the most efficient energy conversion process (> 90%)

It plays a major role in reducing greenhouse gas emissions in terms of avoided generation by fossil fuels. Hydro is a relatively minor source of atmospheric emissions compared with fossil- fired generating options.

Hydropower

Hydropower plants are very often integrated within multipurpose developments which are satisfying other fundamental human needs (e.g., irrigation for food supply, domestic and industrial water supply, and flood protection). The reservoir water may also be used for other functions such as fisheries, discharge regulation downstream for navigation improvements, and recreation. Hydropower plants can help to finance these multipurpose benefits, as well as some environmental improvements in the area, such as the creation of habitat for birds, fish and other creatures.

The small versus large

It is concluded that the most fundamental determinant of the nature and magnitude of impacts of hydropower projects are specific site conditions and not the scale of the project. It is also important to optimize development with respect to the complete river system.

Menu

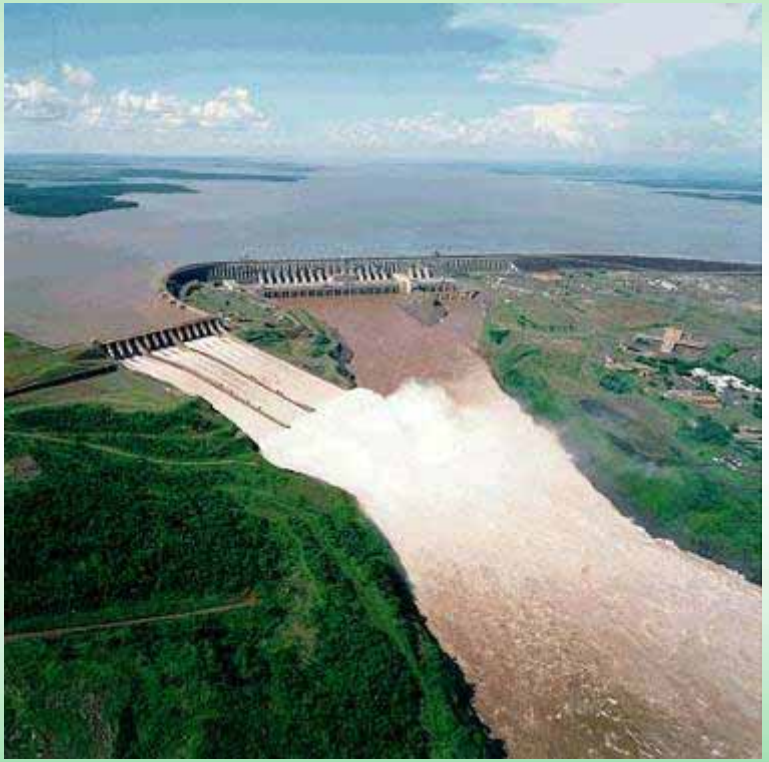
Hydropower

Conclusion

The world's remaining hydroelectric potential should be developed to the maximum possible extent, with projects planned taking full consideration of social and environmental impacts, so that the necessary mitigation measures can be taken. Clearly, the population affected by a project should enjoy a better quality of life as a result of it.

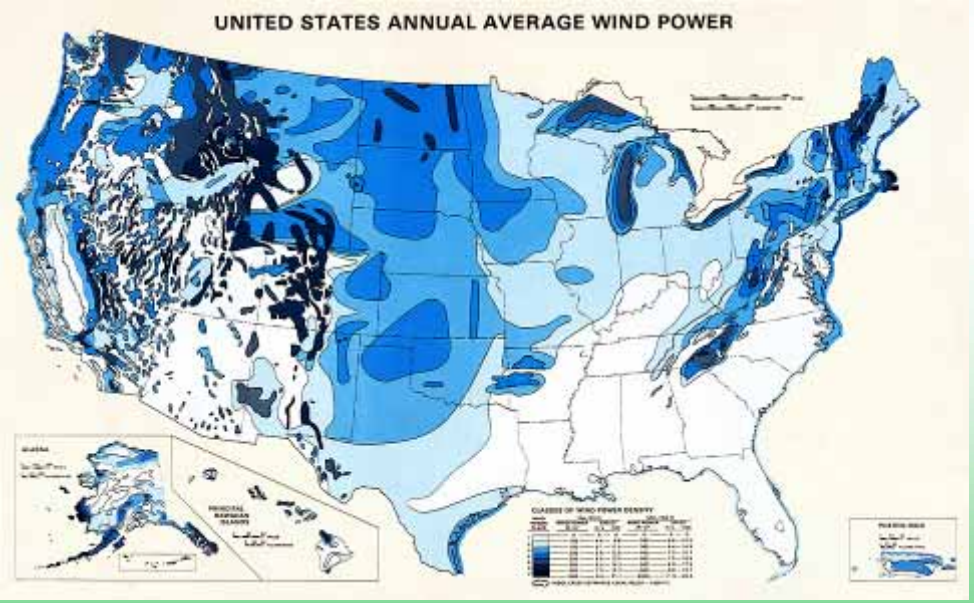
Hydro development should go hand-in-hand (rather than in competition) with further research and development in the field of other renewable options such as solar and wind power. Energy conservation measures should also be optimized and encouraged.

Any development involves change and some degree of compromise, and it is a question of assessing benefits and impacts at an early enough stage and in an adequate detail, with the full involvement of any people to be affected, so that the right balance can be achieved.



Wind

Throughout this century, some remote areas not serviced by electricity grids have used small wind turbines to supply electricity, but the extent of these operations was very small. It was not until the “energy crisis” of the early 1970s, when oil prices skyrocketed, that anybody seriously considered wind as an important source of energy for the future. Since then, new wind turbine designs have been developed which have transformed the wind into a clean, reliable and renewable source of electricity.

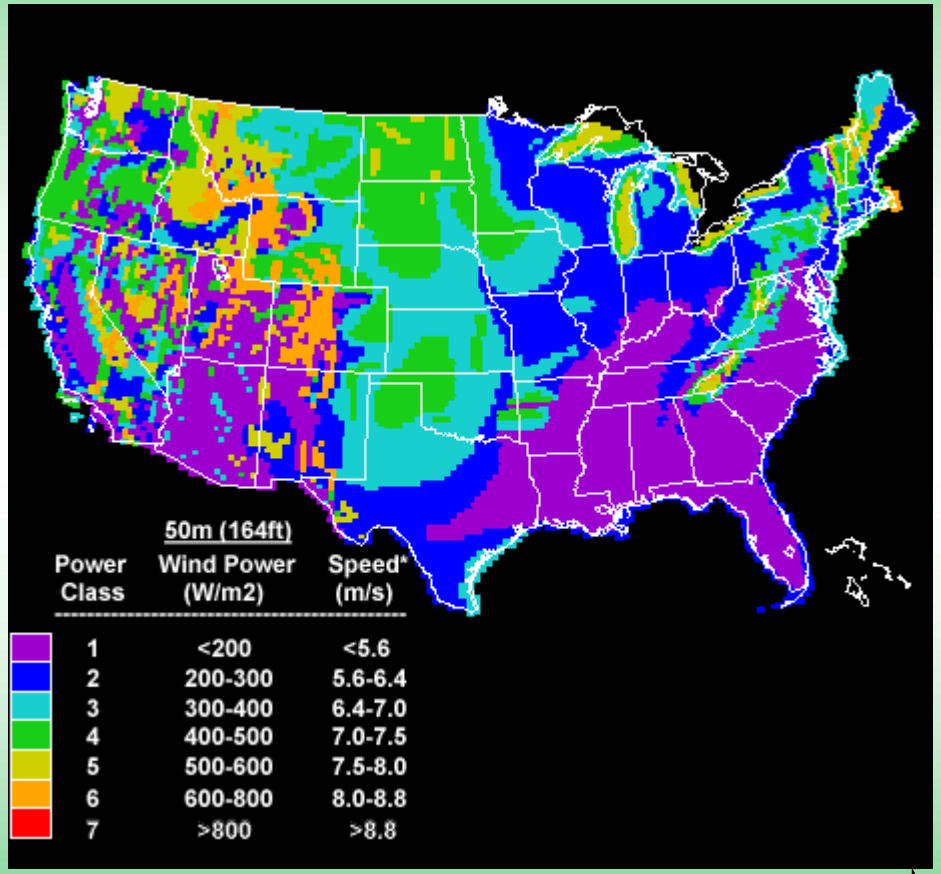


Wind

The Wind Resource

Winds are caused by differential heating of the earth's surface by the sun. Every location on the planet experiences wind, but the absolute amount of wind in any one area is highly variable. Maps of average wind speeds must be developed.

On a worldwide scale, the total kinetic energy contained in the wind is more than 80 times that of human energy consumption. Yet in practice, only a small fraction of this potential resource has been captured to date, due to the dispersed and variable nature of this resource.



Wind

Wind Turbine Technology

Modern wind turbines come in a wide range of sizes, from small 100 watt units designed to provide power for single homes or cottages, to huge turbines with blade diameters over 126 m, generating over 5 MW (5 million watts) of electricity. The vast majority of wind turbines produced at the present time are horizontal axis turbines with three blades, up to 61m long, producing up to 6 MW of electricity. These turbines are often grouped together to form "wind farms" which provide power to an electrical grid.

Wind

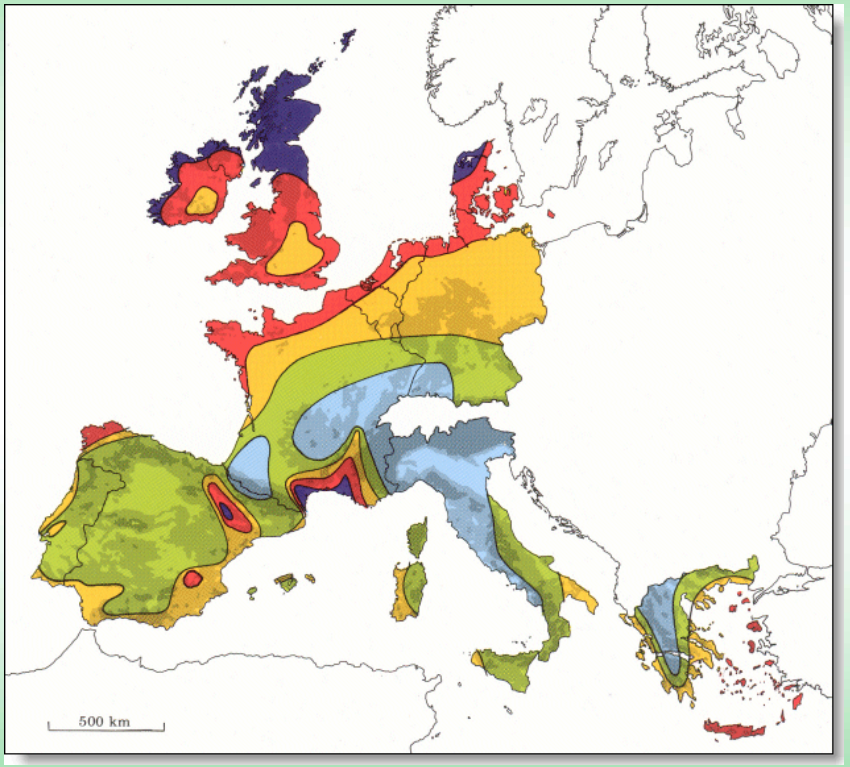
Environmental Impacts

The main environmental concerns surrounding the use of wind energy are impacts on land use, noise, effects on wildlife and disruption of radio transmissions. Since the available wind resource is so spread out, vast areas of land are required to provide significant amounts of electricity. Wind turbines can, however, be placed on areas used for grazing of animals or land of marginal value. The aesthetics of wind farms has also been questioned, but the public seems to accept the thousands of electricity transmission towers which dot our landscape.

Wind

The present situation

In the last decade, the costs of wind generated electricity have decreased considerably, and the reliability of wind turbines has increased dramatically. During the 1980s, the cost of wind generated electricity dropped from about 15 - 20 cents per kWh to the current costs of 4-6 cents per kWh. This is similar to the costs of generating electricity from fossil fuels and is cheaper than the cost of electricity from most recent nuclear power plants. The costs came down largely because of improvements in the reliability of wind turbines, the best of which are now available to operate 95 - 98% of the time.



Wind

The Future of Wind Power

Wind turbines are a mature technology capable of providing large amounts of power at prices competitive with most other sources of electricity. The proliferation of wind turbines as a source of electricity in the future will probably depend more upon the costs of other electricity generating options and public reaction to their environmental impacts than on the improvement of wind turbine technology. Despite this there are a few technological advancements that would improve the potential of wind power.

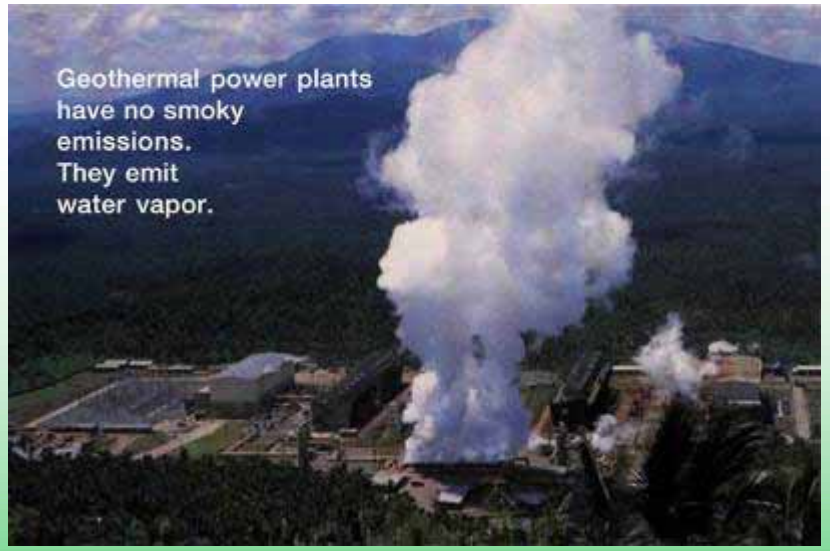
New lightweight composite materials for use in turbine blades could result in larger turbines (over 1 MW) becoming more reliable and thus more cost effective. Similarly advancements in control systems could allow larger turbine blades to be used without experiencing damage during storms. Breakthroughs in electricity storage would also make wind power more attractive as an electricity supply option. The development of "offshore" wind farms in coastal areas would also improve the prospects for wind power.

Geothermal

Geothermal Energy around the World

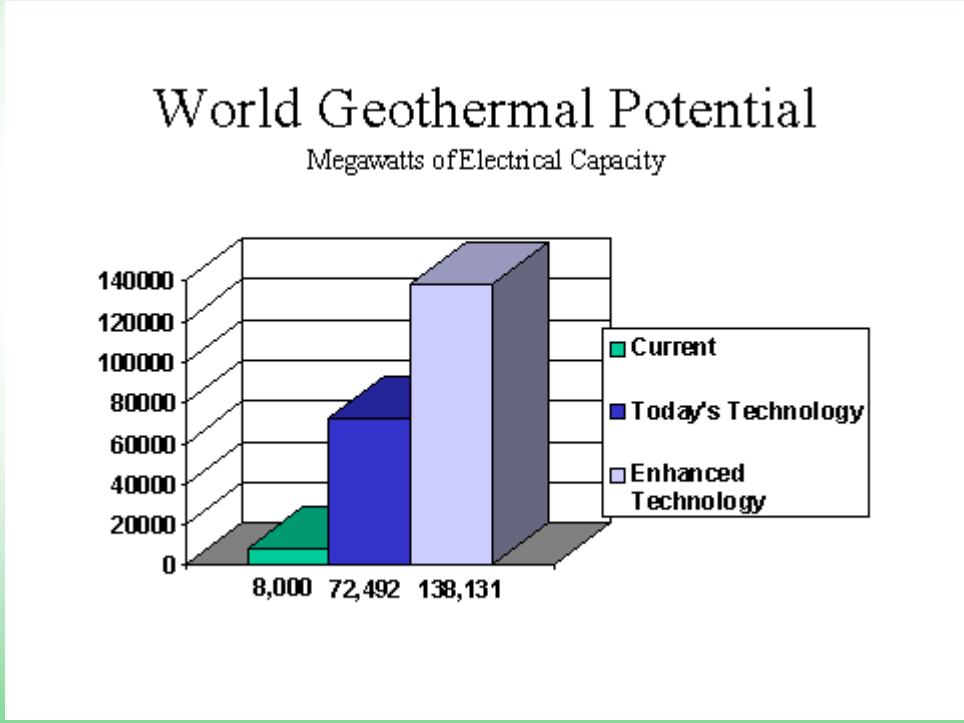
*** Twenty-one countries generate 8,000 megawatts of electricity from geothermal resources, and there are 11,300 thermal megawatts being used in more than 27 countries for direct use applications such as aquaculture and greenhouse operations and industrial processing.**

*** U.S. geothermal companies have installed geothermal power plants overseas that generate more than 1,500 megawatts of electricity and represent and investment of more than $3 billion.**



Geothermal

*** There are nearly 80,000 megawatts of electrical power that could be brought on-line in foreign countries in the next two or three decades using geothermal resources.**



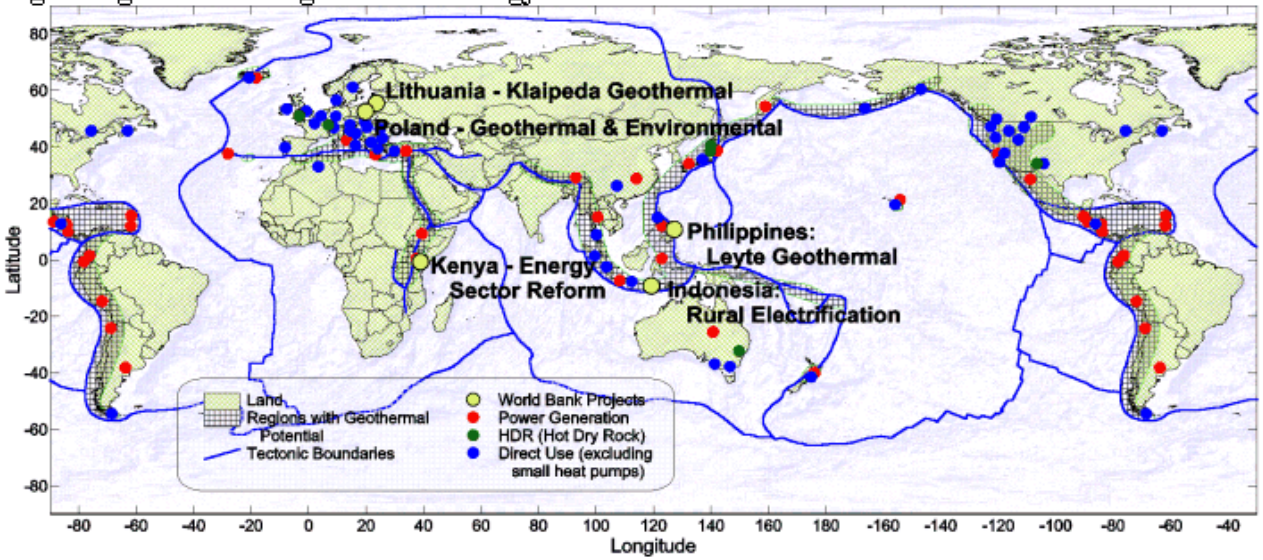
Renewable Energies

Geothermal

Present electric power generation from geothermal energy 1999 (MWs electricity installed)

USA	2850
Philippines	1848
Italy	769
Mexico	753
Indonesia	590
Japan	530
New Zealand	345
Iceland	140
Costa Rica	120
El Salvador	105
Nicaragua	70
Kenya	45
China	32
Guatemala	29
Turkey	20
Totals	8246

Figure a global view of geothermal energy



Other countries with less than 20 MW generation are: Argentina, Australia Ethiopia, France (Guadeloupe), Greece, Portugal (Azores), Russia, Thailand

Source: Source: International Geothermal Association (1998) updated with data published in 1999.

Renewable Energies

Geothermal

Geothermal Energy around the World

Provides clean and safe energy using little lands

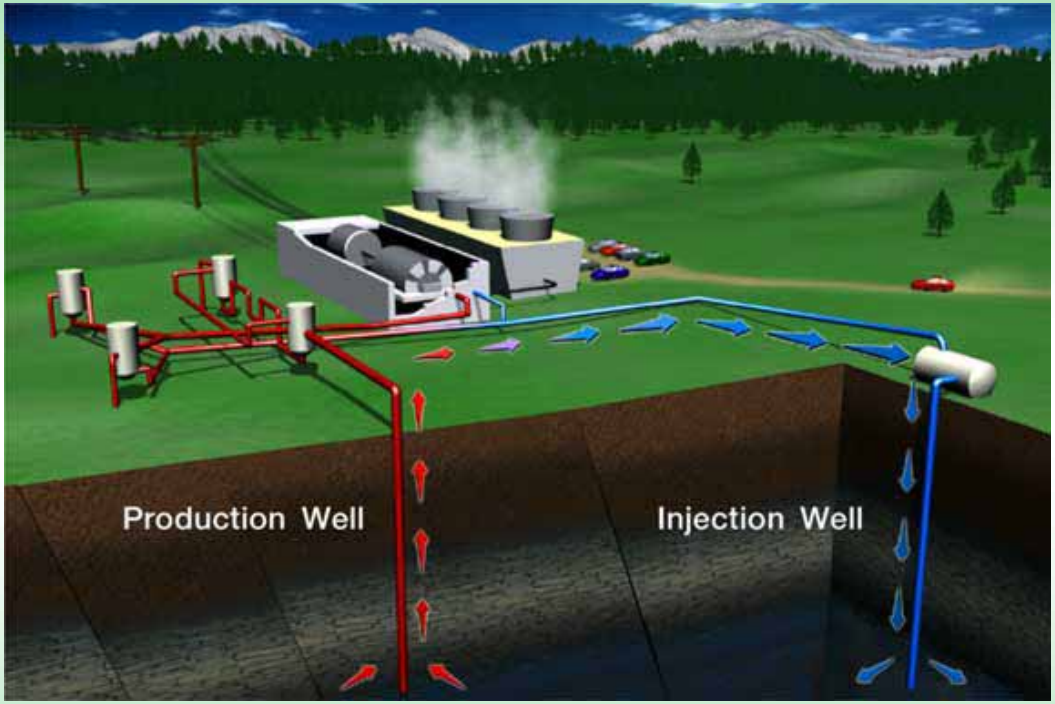
Renewable and sustainable

Generates continuous, reliable baseload power

Conserves fossil fuels and contributes to diversity energy resources

Avoids importing and benefits local economies

Offers modular, incremental development for village power in remote sites or utility scale development.



Biomass Energy

Converting Biomass into useful energy

Biomass energy - the energy contained in plants and organic matter - is one of humanity's earliest sources of energy. Today, various forms of biomass energy account for nearly 4 percent of all energy consumed in the U.S. and 45 percent of renewable energy in the U.S. Biomass is used to meet a variety of energy needs, including generating electricity, heating homes, fueling vehicles and providing process heat for industrial facilities.

Biomass Energy

Biomass Resource

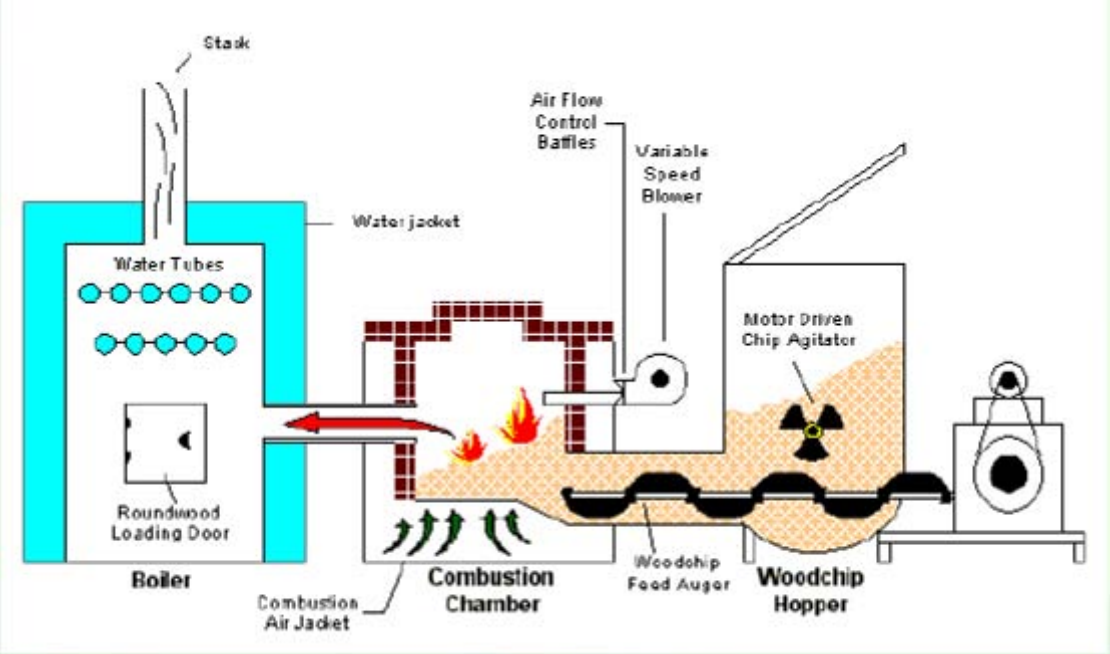
Biomass resources include wood and wood wastes, agricultural crops and their waste byproducts, municipal solid waste, animal wastes, waste from food processing, and aquatic plants and algae.

The majority of biomass energy is produced from wood and wood wastes (64 percent), followed by municipal solid waste (24 percent), agricultural waste (5 percent) and landfill gases (5 percent). Dedicated energy crops - fast-growing grasses and trees grown specifically for energy production - are also expected to make a significant contribution in the next few years.

Biomass Energy

Generating Electricity

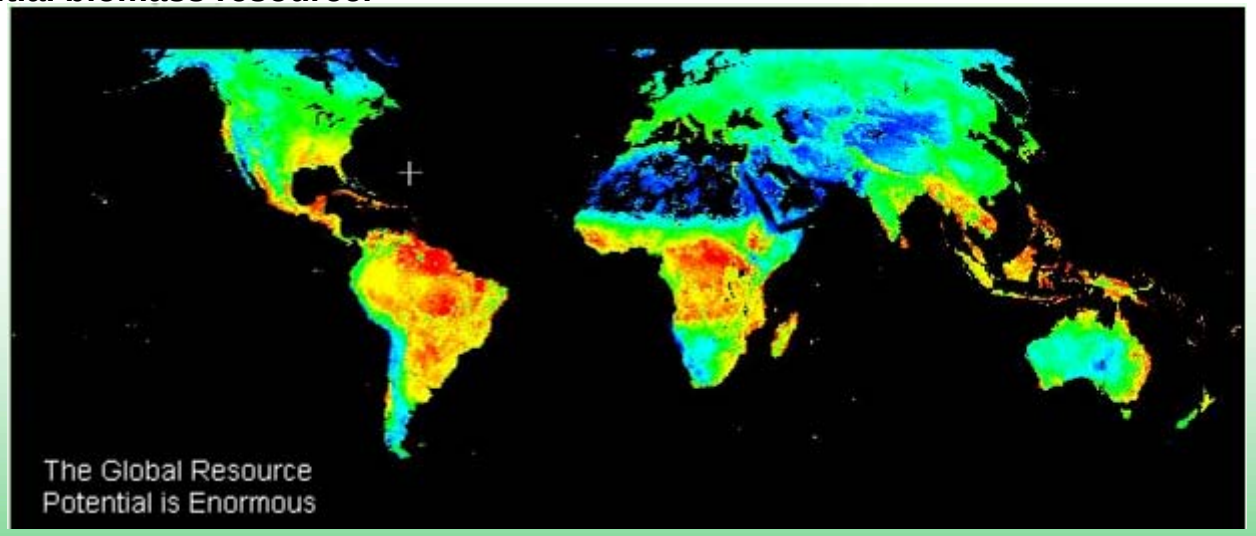
U.S. utilities use biomass to generate more than 7,500 megawatts of electricity - enough power to meet the energy needs of several million households. Although the electricity is produced by direct combustion, advanced gasification and pyrolysis technologies - which are potentially more efficient and use a wider variety of biomass material - are almost ready for commercial-scale use.



Biomass Energy

Potential

Of the 14 quads (1 quad =10^{15} Btu equivalent of 170 million barrels of oil) of biomass resources currently available, the U.S. uses 3 quads (total U.S. consumption from all energy sources is 84 quads). However, our potential biomass resource - including energy crops - is estimated at 55 quads, of which 17 to 20 quads could reasonably be exploited by the year 2030. Energy crops, which could be grown on our nation's 50 million acres of idle farmland, represent the largest potential biomass resource.



Biomass Energy

Conclusion

Biomass currently supplies 14% of the world's energy needs, but has the theoretical potential to supply 100%. Most present day production and use of biomass for energy is carried out in a very unsustainable manner with a great many negative environment consequences. If biomass is to supply a greater proportion of the world's energy needs in the future, the challenge will be to produce sustainable biomass and to convert and use it without harming the natural environment.

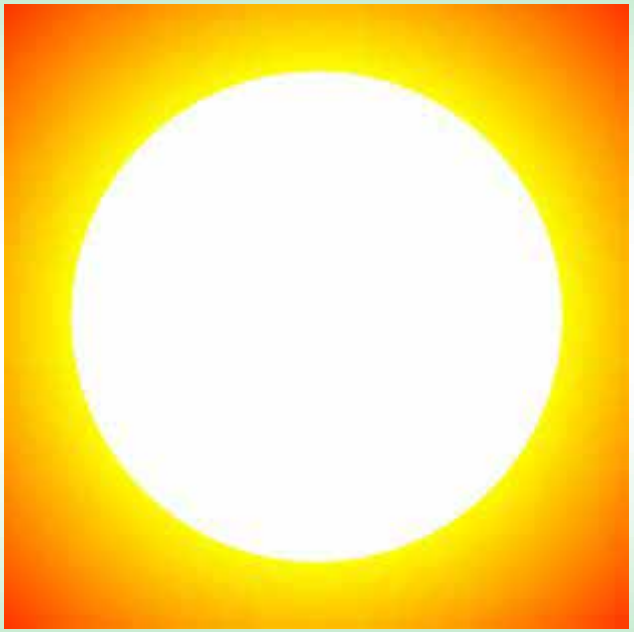
Technologies and processes exist today which, if used properly, make biomass-based fuels less harmful to the environment than fossil fuels. Applying these technologies and processes on a site specific basis to minimize negative environmental impacts is a prerequisite for sustainable use of biomass energy in the future.

Solar

Solar Energy

Tapping the Earth's largest energy resource:

The sun showers the Earth with a nearly infinite supply of energy. Each day more solar energy falls to the Earth than the total amount of energy the planet's 6.6 billion inhabitants would consume in 27 years. While it's neither possible nor necessary to use but a small portion of this energy, we've hardly begun to tap the potential of solar energy.



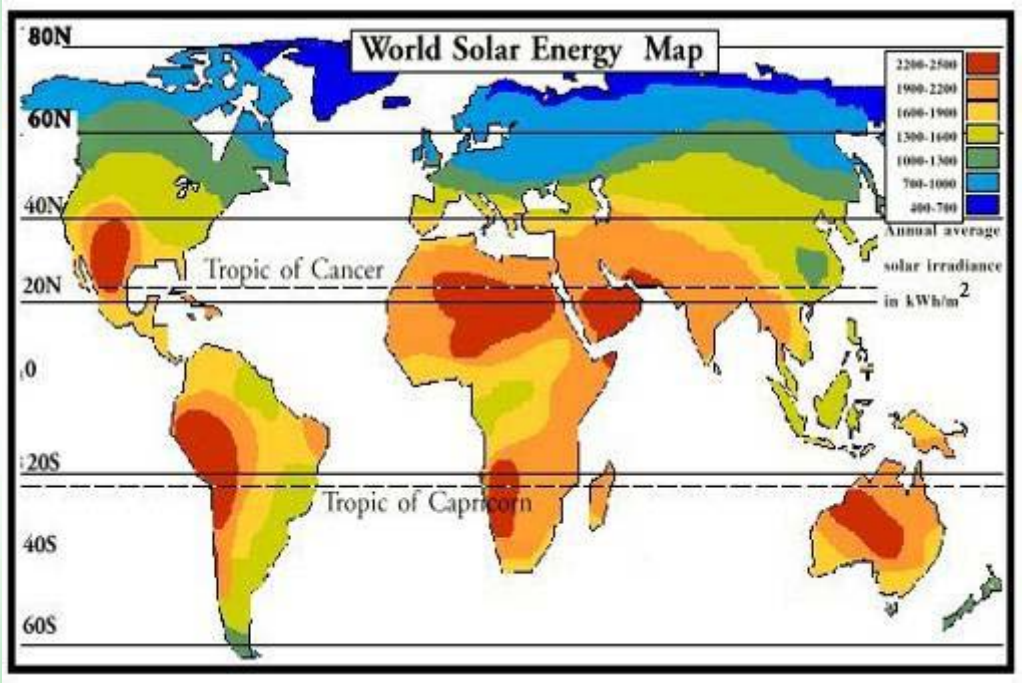
Solar

Only in the last few decades, when growing energy demands, increasing environmental problems and declining fossil fuel resources made us look to alternative energy options, have we focused our attention on truly exploiting this tremendous resource.

Solar

The Resource

Although every location on the earth receives sunlight, the amount varies greatly depending on geographical location, time of day, season and clouds. The southwestern United States is one the world's best areas for sunlight. This desert region receives almost twice the sunlight as other regions in the U.S. Globally, other areas receiving very high solar intensities include developing nations in Asia, Africa and Latin America, shown in red here.



Solar

Benefits/ Obstacles

Solar energy technologies offer a clean, renewable and domestic energy source. Power generating systems also are modular, meaning they can be constructed to meet any size requirement and are easily enlarged to meet changing energy needs.

Solar energy technologies have made huge technological cost improvements, but, except for certain niche markets such as remote power applications, are still more expensive than traditional energy sources. Researchers continue to develop technologies that will make solar energy technology - particularly power generating technologies - cost competitive with fossil fuels.

Solar

Potential

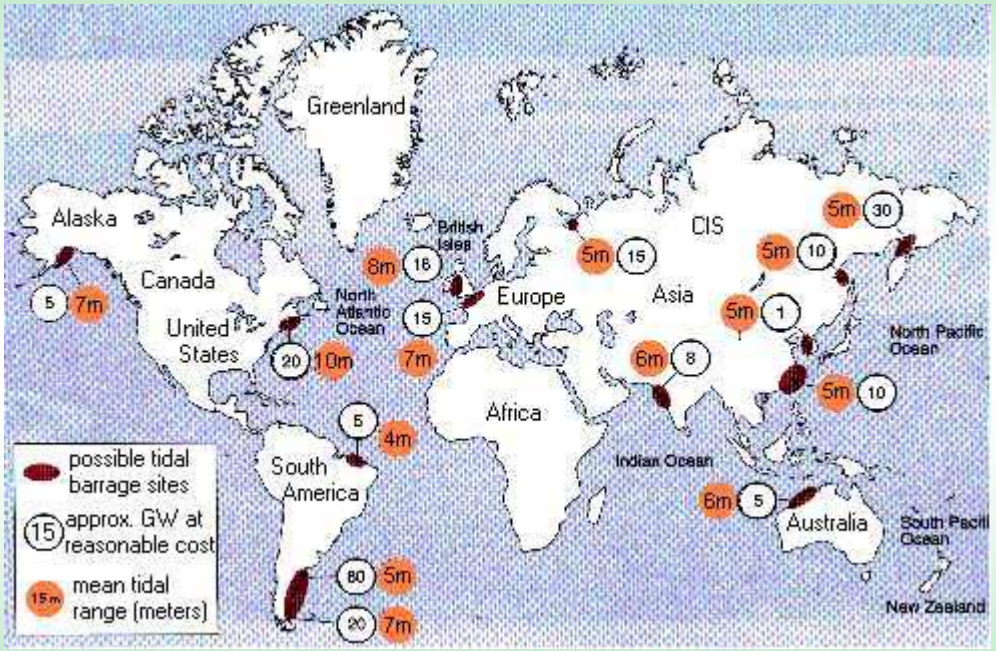
Developing countries, where 1.6 billion of the world's population is currently without electricity and where sunlight is usually abundant, represent the biggest and fastest growing market for power producing technologies. The large potential domestic market for power production technologies is the utility sector.

Renewable Energies

Tidal

There are a number of sites around the world that have the right combination of coast geometry and significantly large tidal range to make them potential sites for tidal power plants.

The figure at the right indicates the potential sites for a traditional barrage system. It also indicates the estimated potential generating capacity of each site for a reasonable capacity outlay and shows the mean tidal range in meters.



Renewable Energies

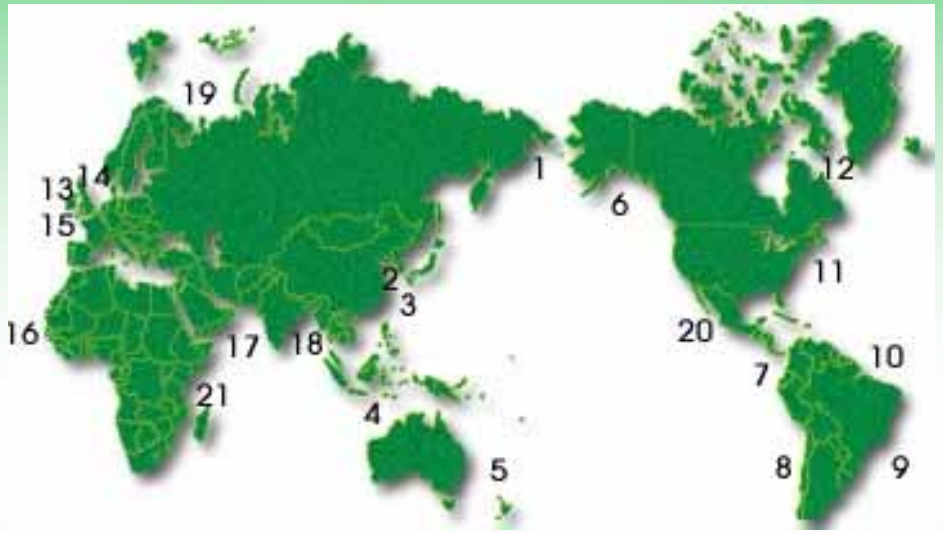
Tidal

The following figure shows the recommended sites for the *Tidal Electric Tidal Generator* system.

There are six tidal power stations in operation at present, most producing less than one megawatt of electricity. The largest tidal power station, built in 1965, is on the La Rance River estuary in France and has 24 ten-megawatt turbines with reversible blades.

Tidal power plants currently in planning include a 40-megawatt plant in Nova Scotia and a 400-kilowatt plant in Russia.

In Australia, several studies have been made of the potential for tidal power stations in the Kimberley region on the northwest coast of Western Australia. The tidal range throughout that area is suitable, between nine and twelve meters, however, environmental concerns such as possible silting of the bays needs to be considered.



1. Siberia
2. Inchon, Korea
3. Hangchow, China
4. Hall's Point, Australia
5. New Zealand
6. Anchorage, Alaska
7. Panama
8. Chile
9. Punta Loyola, Argentina
10. Brazil
11. Bay of Fundy
12. Frobisher Bay, Canada
13. England
14. Antwerp, Belgium
15. LeHavre, France
16. Guinea
17. Gujarat, India
18. Burma
19. Semzha River, Russia
20. Colorado River, Mexico
21. Madagascar

On the Atlantic Coast of France

Benefits

Utility and Operator Efficiencies

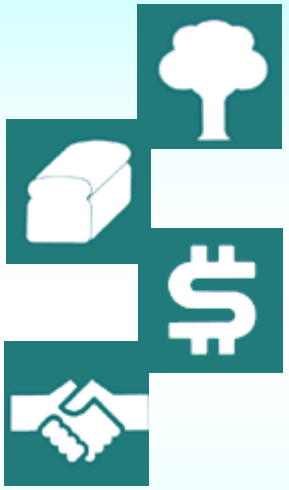
Stabilized Population Growth

Reduction of Fossil Fuel Use and Pollution

Reduction of Hunger and Poverty

Enhanced Trade, Cooperation and Peace

Endorsements



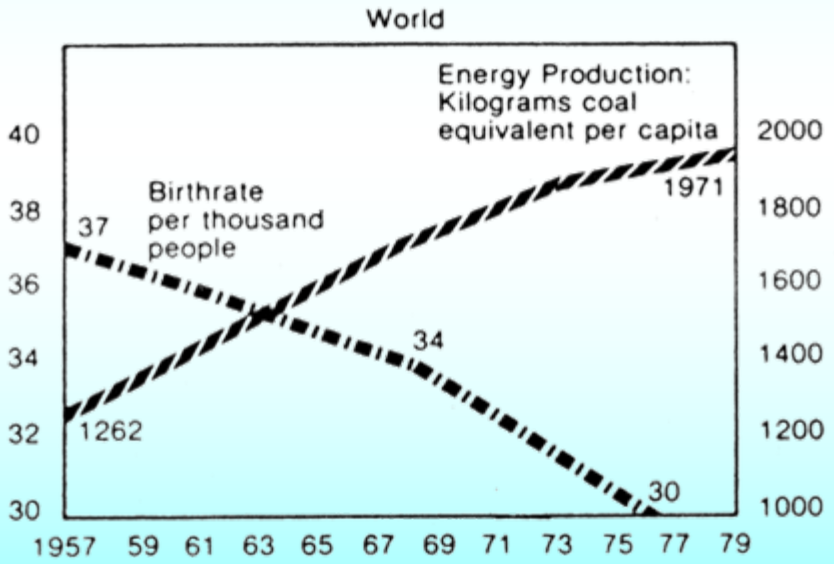
Utility and Operation Efficiencies

Utilities and system operators realize tremendous benefit through grid connections. Large interconnected networks now exist in every developed society. While all transmission lines had to first be justified economically, many additional benefits exist for grid system management and reliability:

- **Load sharing between utilities**
- **Emergency back-up power from neighboring utilities**
- **Peak power saving through daytime power exchange**
- **Deferral of additional capacity requirements**
- **Increased system reliability**
- **Improved frequency and voltage control**
- **Ability to retire older and ecologically unsound generation**

Stabilized Population Growth

As electricity becomes available to a society, the initial uses are to pump and filter drinking water, refrigerate medicine and to light a schoolhouse and health clinic. This causes a reduction in the infant mortality rate, which in turn causes a lowering of birth rates. The need for "insurance births" as social security for parents is dissipated when electricity is introduced in a society.



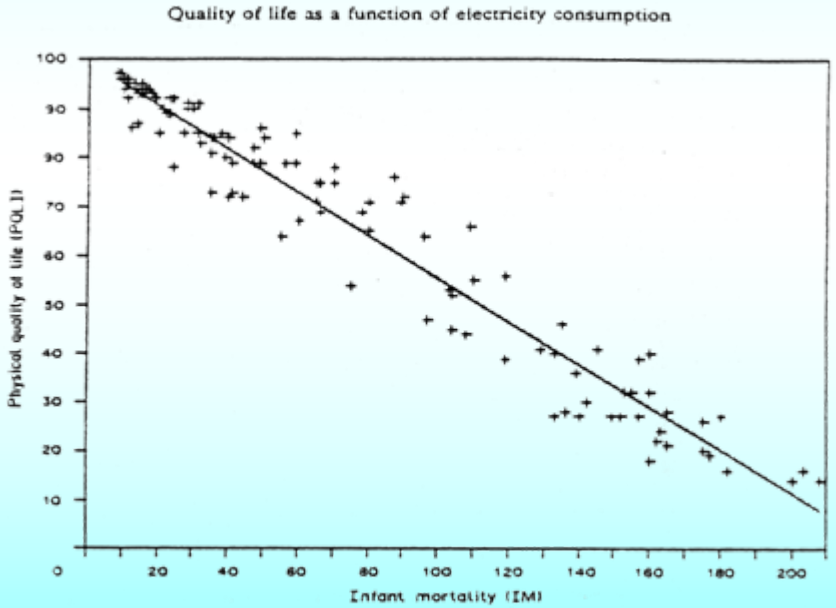


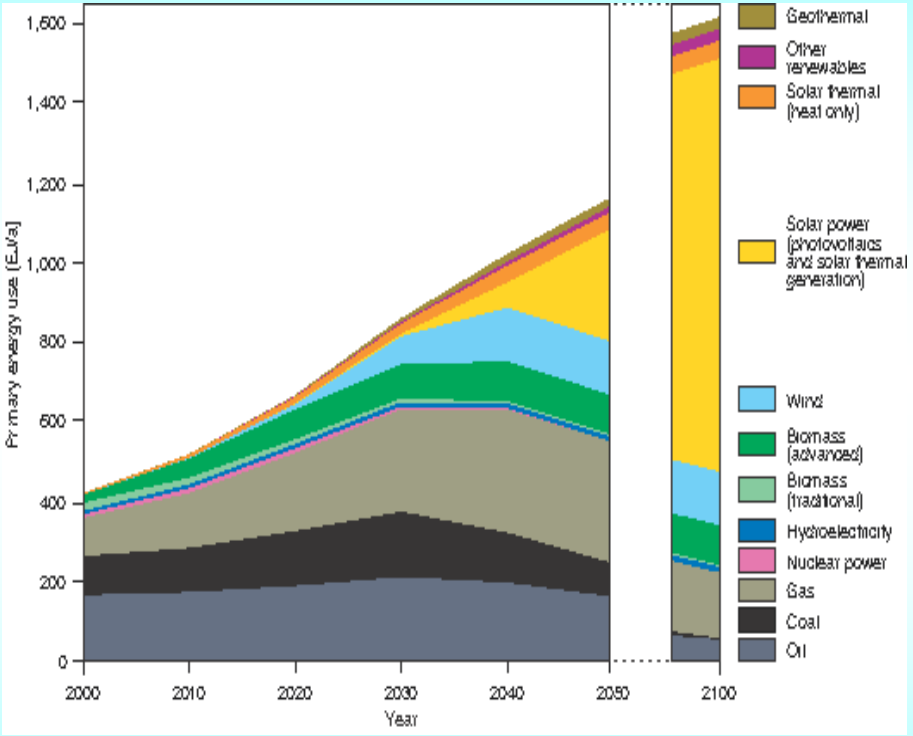
Fig. 6. Comparison of reported (+) and correlated values (——) of PQLI vs IM.

Benefits

Reduction of Fossil Fuel Use and Pollution

Today, over 80% of global power production is from fossil or nuclear fuel, and the balance split between biomass and hydropower. Wind, solar and geothermal provide a growing but, as yet, nominal share of electrical production.

The global renewable energy potential is far beyond the needs of humanity -- yet often located in remote locations. High voltage transmission can now link nations and continents, making large renewable capacity available to load centers and reducing the pollution from traditional power production.



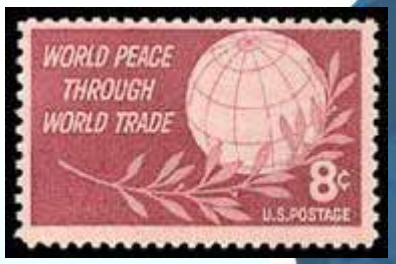
Benefits

Reduction of Hunger and Poverty

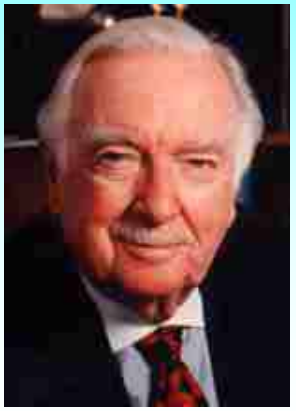
Research shows that 2000 kwh/capita/year provides basic electrical needs to be met. At this threshold, drinking water, refrigeration of medicine and simple lighting enable a society to move beyond basic survival. 1.6 billion people still have none and another two billion have an unreliable supply.

Enhanced Trade, Cooperation and Peace

“It is bad business to shoot at your customer or supplier.” Building infrastructure across borders requires cooperation between bankers, engineers and policy-makers. Mutually beneficial trade between neighbors is a driver for peace.



Endorsements



Many years ago, I was honored to spend time with a true visionary of our time, Dr. R. Buckminster Fuller. He preferred that I call him Bucky. This Renaissance man gave us the Geodesic Dome, the Dymaxion map (a very accurate and unique view of our planet), synergetic mathematics and the World Game^{tm} -- a global simulation tool that posed the following question: How do we make the world work for 100% of humanity in the shortest possible time through spontaneous cooperation without ecological damage or disadvantage to anyone?

The answer to this provocative inquiry has given me hope. In particular, the premier solution offers the most thoughtful strategy towards peace and sustainable development that I have seen. Simply stated, the proposal is to interconnect electrical energy networks between nations and continents, with an emphasis on tapping the abundant renewable energy resources of our planet. In today's terms, we might call this a world wide web of electricity using green energy resources. Bucky saw this possibility decades before the rest of us.

The problems of humanity threaten each of us -- yet our ignorance makes us believe that somehow we can remain immune. That just isn't so. The critical issues we face have time frames much longer than any political term of office. These problems are interconnected, which suggest that the solutions will also be interconnected. We need more comprehensive thinking and long-range planning. I invite you to investigate the GENI Initiative as I have. It offers help for all humanity.

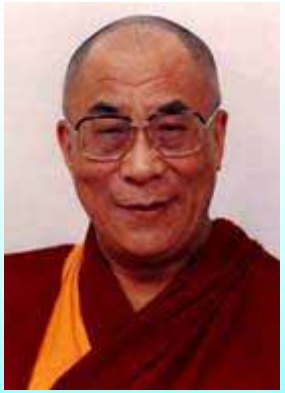
Walter Cronkite, News Anchorman

Endorsements

"I support with enthusiasm your Initiative. While directing the Foreign Affairs of Egypt between 1977- 1991, I have advocated the integration of the electricity grids of all the African countries of the Nile River using the Nile as the infrastructure of this project. I believe, as you do, that electricity must be at the service of peace and international co-operation."

Boutros Boutros- Ghali, Former Secretary General, United Nations

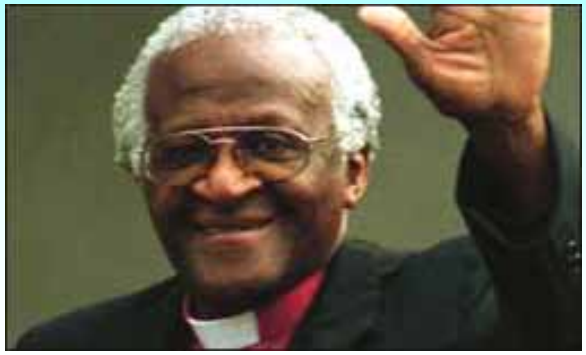
"The Global Energy Network Initiative plans to undertake various regional projects that will be benefit humanity and the planet. According to GENI, they plan to increase universal living standard, reduce the cost of electricity, reduce pollution from fossil fuel and nuclear generation, reduce poverty and hunger around the world, stabilize population growth and promote international trade, cooperation and peace. I fully support these initiatives by GENI."



His Holiness, The Dalai Lama

Endorsements

"The GENI proposal, encouraging the interdependence of nations through the sharing of energy resources, is most exciting. One of the obscenities of Southern Africa is to see electric power lines strung across a rural landscape overshadowing communities where women spend most of their day walking kilometers to find firewood just to survive. I would support an initiative that promotes the distribution of energy to those that are condemned to a cycle of servitude. The opportunities for co-operation and increased international understanding through the establishment of an international power grid would be substantial. I wish you well with your efforts."



The Most Revd. Desmond M. Tutu Archbishop Emeritus of South Africa, Chairperson of Truth & Reconciliation Commission, Nobel Peace Prize Laureate

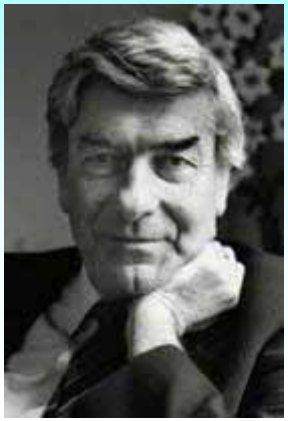
"The electrical power business has grown remarkably in this century across the globe. However, the quantity of electricity traded internationally is abysmally small. Interconnecting grids internationally would permit the generation and transfer of electricity at least possible cost, which would not only ensure efficient utilization of natural resources, but also provide access to tapping efficiently generated power across international boundaries. The environmental and economic benefits from this approach could have revolutionary significance."

Ragendra K Pachuri, Ph.D., Director of Tata Energy Research Institute, 2007 Nobel Laureate and Chairman of the UN IPCC

Endorsements

"The GENI initiative fits right into the more and more independent world. Globalization is about a more and more borderless world and the need to respond globally to the needs of mankind. To preserve our common base, the Earth, we need to join forces to generate electricity as environmentally friendly as possible. This is crucial, and, therefore, GENI deserves support."

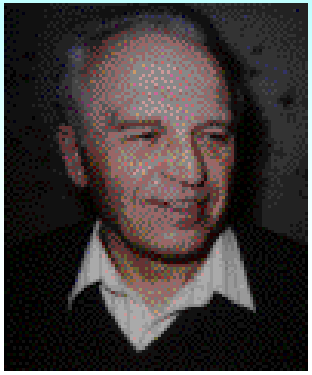
Dr. Ruud Lubbers, former Prime Minister of the Netherlands (1982- 1994)



" We are absolutely in agreement with this initiative and we want to let you know that we will be supporting all works that you develop in this relation."

Vicente Fox- President, Mexico.

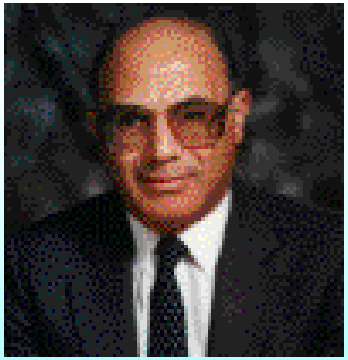
Endorsements



"We must see the problem as a whole. We must understand and explain to all other men on our planet that the interconnection of power systems of different countries is one of the important tasks for all humanity."

Victor Yershevich, Director of Science, Energoset Project

" We estimate that by 2050, the electricity may account for 60% to 70% of the energy consumed…because of these trends there will be growing trade in power, not just between neighboring countries, but across neighbor countries to a third country. All this demands strong interconnections. Extra-high voltage (EHV) transmission will become more important for wheeling. Research into EHV in the future is going to be paramount importance."



Hisham Khatib, Chair, Committee on Energy Issue in Developing Countries, Vice President, World Energy Council

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GENI

What is GENI?

The Global Energy Network Institute (GENI) is a non-profit research and educational organization. The GENI Initiative focuses on the electrical power grids between nations and continents, with an emphasis on tapping renewable energy resources. This is the “highest priority objective” of the World Game simulation designed by visionary engineer Buckminster Fuller.

GENI is supported through the contributions of individuals, corporations and foundations. We invite you to assist in this global initiative.

Peter Meisen, Founder & President

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