

# THE IMPACT OF REFORMS ON POWER AND TELECOMMUNICATION

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## SUMMARY

I want to show, as many before me have done that power and Telecommunication reforms are fundamental keys to all development. It is shown that reforms as such do not perform the miracles, but rather, the human capital "s adequacy must meticulously ~~put in place all the proposed reforms~~. It is shown that if this is not the case; and indeed it is not yet the case, the human capital is therefore the cause of the failures of the reforms today. It is recommended that there must be a shift in the strategic resource (for continuing development) from the present clearly weak industrial/agricultural to an information/energy adequacy society. In our present industrial economically weak society, the strategic resource has been a very poorly utilised human capital because of the wicked selfishness exhibited by those who should know. In the adequate information/energy society we must have to build, the key resource must shift to information/energy, knowledge and creativity. And this can only be found by the corporations in their employees. This means a whole new emphasis on human resources or human capital development for the millennium goal. And in this, true work becomes "The Immortal Necessity for the good".

### 1. Introduction

It is an inevitable requirement that man must thoroughly know and understand nature and the environment in which he lives. Hence, we must say that we live in a Universe, meticulously governed by Lawfulness, Energy and Knowledge 1 (LEK). In the midst of this triad, we have our being on earth, and even when we leave the earth to the greater beyond. Therefore the practitioner must

have the knowledge of power and the necessary reforms, as well as the computers/information technology and the overall necessary knowledge of the telecommunications reforms; so that each of the two groups (power and telecommunication) can adequately function as respected engineers must do.

To reform means to improve the system that had existed. This means, the Laws for electric power supply and information technology/telecommunication have to be reformed; so that the performance characteristics of the energy and telecommunication systems are separately to be improved upon<sup>2</sup>. The respective areas of knowledge must be improved upon so that the human capital requirements, must go deeper, and each engineer wanting to work with the reforms, now the vogue, must exert him self to the extreme so as to perform in the reforms to the limits of his abilities.

### 2. The Basic Reforms

#### 2.1 Basic Power Reforms.

The power reforms are concerned with power generation, transmission and distribution companies instead of the present or earlier traditional vertically integrated utility system (PHCN); that is creating new entities that can function independently.

There is then a set up of an independent system operator (ISO) that coordinates all power generation and transmission; with power distribution in the electricity supply industry before the consumers " terminals. The ISO is the leading entity in the power market<sup>5</sup> operations and its function determines market rules. The key market<sup>5</sup> operations entities are usually,

- (a) **GENCOS** – Power generating Companies
- (b) **TRANSCOS**– Power transmitting Companies (or I S O)
- (c) **DISCOS** – Power distribution Companies and
- (d) **RETAILCOS** – which includes the aggregators, brokers, marketers and customers.

The latters are very often taken for granted in our present system.

But we should swing in the direction to which technology is ever again advancing.

Figure 1 shows the representation of **GENCO/TRANSCO** diagrammatic connection: Re-  
**Generation/Transmission** Interconnection system – the grid.

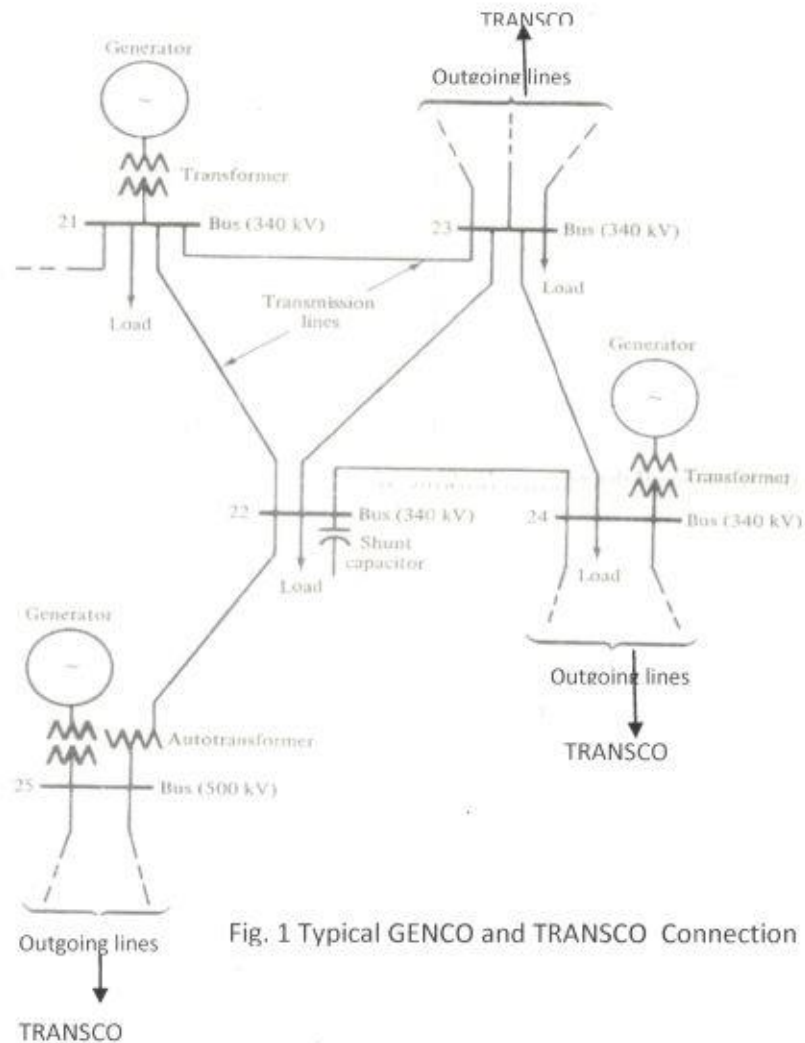


Fig. 1 Typical GENCO and TRANSCO Connection

The country's power generation systems are slowly moving in the direction of Independent power plant (IPP) Projects and generated power is sold to would be independent marketers<sup>5</sup> and power distributors to consumers. Between the power distributors and power generation are the power transmission groups popularly called Transco (transmission companies). (5)

These new concepts are already being practised in many countries<sup>(5)</sup>, basing electricity pricing, on Power Purchase Agreement (PPA) power distributors (4) to be signed between the power producer / owner, and the supply authority.

Power generation is a very expensive economic activity. All concerned must know for sure that energy availability is the main driver of a nation's economic activity, as well as the main power availability to lubricate the driven wheels of all social systems.

Consider that the power purchase agreement (PPA) will of necessity mean that the power purchaser will take or pay for the energy generated; just as well, a generating company has an obligation to generate and deliver power at a Minimum Energy Quantity (MEQ)<sup>4</sup> of net electrical output which the power distribution company must also take or pay for.

5. The MEQ must be equivalent to the net power output that would be generated by the plant at an annual capacity factor of at least 85%, if indeed the generating company has to stay in business be competitive, and make legitimate profit.

#### 4. Tariff Concept

Electricity tariffs<sup>2</sup> are set up to recover all costs investments in the electricity production, distribution and even transmission, in the electricity



supply industry world wide. This used to be the pyramid system of power supply such as PHCN.

Figure 2 shows the typical ex-plant tariff components. The tariff takes full account of all the

cost components of power generation leading to forming a satisfactory tariff, which must also include transmission, distribution and utilization costs.

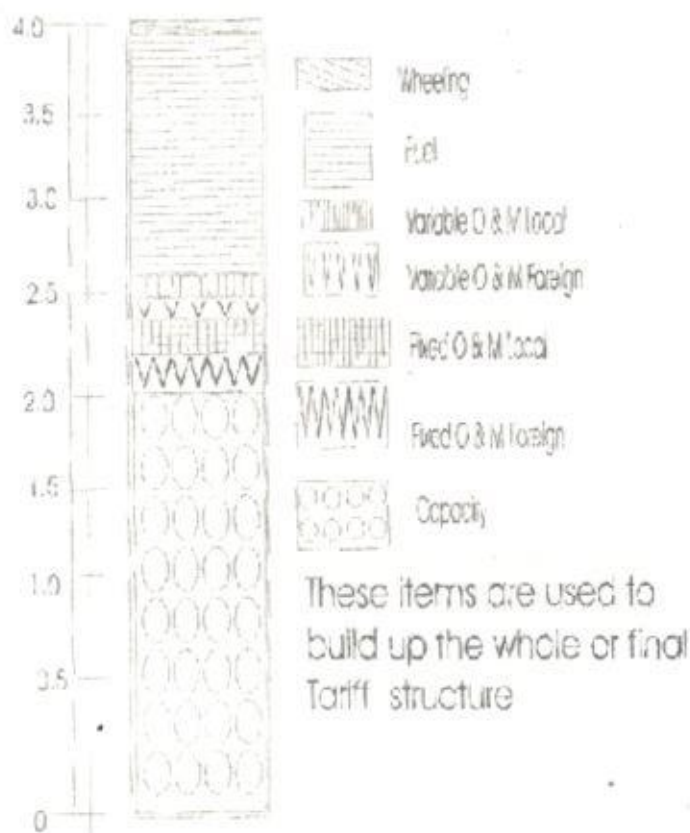


Fig: 2 EX-PLANT TARIFF BREAKDOWN Tariff = ₦

An agreement will be reached as to how agreeable the tariff structure and its components will satisfy the power sellers' and buyers' aspirations. However, the ex-plant's tariff must cover all cost components for power production/generation, as well as the buyer's ability to purchase power, sell and make profit. In the case of the electricity buyer, there is another buyers tariff so as to profitably market the electric energy purchased from **Gencos**. In some cases which affect total development, Government's subsidy may become necessary as this, "new concept" is being further developed; for it will naturally take time to mature.

In the Nigerian case, the ISO is named as: Nigeria Bulk Electricity Trading (NEBT) PLC, with a Board (Guardian, re, 17-08-11). The paper also published that, "The Power Holding Company of Nigeria (PHCN) which hitherto managed the process owes huge debts from previous power purchase agreements (PPA) it signed with

independent producers such as Agip, Shell and Ibom Power, ₦60 billion. This amount seems incredible and how it can be so high bits all imaginations.

### 3.2 Telecommunications Reforms

Clearly, the Global System Mobile (GSM) has come to stay as a reform system. It is the revolution of our time. Further, the basic reforms in telecommunications systems to be privatised are; Nigerian Telecommunications Limited, NITEL and Mobile Telecommunications, MTEL. Already in private communications are the MTN, Globacom, Airtel and others. The reliability of mobile phones may be questionable; however, the subscriber does not always go through whenever he calls. The complexity of communication must include radio, television and various security systems; including internet communication within organisations. Today we have the Global Communication Internet and the Global Library System.

Figs 4 and 5 further illustrate the versatile nature of these systems. On the whole, the telecommunication systems are less problematic in comparison with the power supply system. However, there is room for improvement with time as the human capital improves. From here on we shall concentrate more on energy, Power and human capital reforms.

4. **The Energy Concept.**

Both the power supply and telecommunication reforms clearly show that both are energy and knowledge base driven systems. This (fig.1 and 2) had already been explained. Once again the energy and knowledge requirements are involved; and almost in every case energy and knowledge are put to use always simultaneously. Hence again the human capital is ever again most important. Figures 3, 4, and 5 show the works of others. And what has been our human capital inputs to these figures as Africans. Let us deeply reflect, more than ever before.

5. **Lawfulness and The Truth**

In truth, every human being must take the necessary lawfulness into fullest account in all he does. That is, in his thinking, words and deeds. And "all achievements whether in business, intellectual or spiritual World are the results of definitely directed thought, are governed by the same Law and are of the same method."

Out of this "triad", plus his intuitive perceptions (if he has reached that level of perceiving things, visible and invisible) comes all he does. When we do things according to our own human laws truly, and operate them accordingly, we fair well and the systems operate in a satisfactory manner. But when on our own, we break these our own human laws and also do not take into account God's Laws which are adamant and inexorable, from eternity to eternity, and because of our selfishness which now takes the lead manifesting as the most wicked invention, world wide corruption, we see that this diversion from the Truth and Lawfulness, and because of the Law of Reciprocal Action (or what a man sows he will reap many times over) we will surely bring about disasters to ourselves. This disobedience of Lawfulness in most things we do; which also mean "when there is no love for one another, plants and animals, birds and the whole environment, nothing truly good can happen". And behold, the mess called pollution is, mainly caused by engineers and scientists as the adverse effects of our works

Now everywhere in this wonderful Creation of God, the World, or The Universe, and more recently it is called Subsequent Creation; there is absolute Lawfulness. Just reflect on the logic and consistency of Nature; the Solar System, its sun and the planets as well as the satellites of the planets; there in logic and consistency in the eternal

law of perpetual Development, hence the necessary Lawfulness in every happening "Thus man stands in and under the Law of Creation". That is the Laws of God, for he is a child of this Lawful Creation and he can only develop out of it in the living Laws which operate vitally and automatically in the wonderful world Universe of God. But behold, we think only of the Earth instead of the whole Mighty Universe.

Ladies and gentlemen, where is operation green revolution, operation feed your Nation, ECN, NEPA, PHCN; Now we are going into GENCOS, TRANSCOS, DISCOS, etc, look at our schools, roads, water supplies, reforms upon reforms over and over again are with us. We are not even sure if the last of the constitution and states creation have come to stay or to an end. After all said and done, nothing is working satisfactorily. And when I read the words that follow, I become more frightened for myself. "Wherever you look, there is failure everywhere" (ABD-RU-SHIN).

This is because the human being or man in the exercise of his free will, has refused to use the gifts of Love, talents and abilities for doing only what is good, but these gifts have been used otherwise; not in positivity in his action<sup>5</sup> but more in negativities.

In all educational systems, now, not much that can help has been taught to pupils at present. Hence it is said: "Whatever Earth man does is wrong because he has turned away from God. Before he can again find grace in the sight of God, everything must first become new from ground up" as predicted in the Book of Revelation in the Bible<sup>7</sup>

Therefore, the first and the only necessary reform is man himself so that he can become the true man that he is, or should have become many years/centuries ago. And on this negativity Dennis Kimbro<sup>8</sup> and Napoleon Hill, had this to say; "Beware of the most dangerous and destructive force (or negative use of God Power) on earth – a negative mental attitude". Let us also remember that in every action decision happening taken by man, there must be a consequence: good or bad; in either case strictly according to God's Laws.

In this greatest struggle for man to live in accord with Lawfulness, Charles Hannel<sup>9</sup>, had this to say. "What shall we think about first?" He continued "To think correctly and accurately, we must know the "Truth" (from God). "The Truth then is the underlying principle in every **business and social relations**. It is a condition precedent to **every right action**, and should include all aspects of the development of technology<sup>9</sup>. To know the Truth (from God), to be sure, to be confident, affords a satisfaction beside which no other is at all comparable. Thus to think, speak and act according to the Truth is the only solid ground in a world of doubt, conflicts, and dangers;" and indeed selfishness and corruption which are wicked



negativities and we are clearly on the path to destruction of our selves and our nation. But Lawfulness comes from the Truth. However the whole Mighty Universe is supported by the Truth from God. All humanity is a part of the Great Universe (fig 3). In the attached photos we see how expansive the Universe is; solar system, galaxies and it talks of hundreds of thousands of suns and their solar systems in the Mighty Universe; And above all the Power of God is poured radiatingly unto the Mighty Universe reaching every galaxy, every star, planets, and indeed every species in the Universe. Thus the earth (and hence man) is the focal point of the radiating halos of the Universe. These radiations are given to the spirit of man for its well-being. Once more, and as in every former reform man has refused to reform himself; and this

is the case in every sector of human society in Nigeria. Now we must say good bye to this weaknesses.

In some work we are doing, yet to be completed, we have seen that consumer's terminal voltages are varying between 90 volts and 186 volts instead of staying at 220/230 volts. We all know that power reliability is very low; and the tests show that reliability can be as low as 0.3 to 0.75 of the declared volts. But yet this low power availability/reliability is not taken into account when some consumers who have no meters are billed. Table 1 shows some of these results. Indeed with reforms, ever facing the consumers anew, power reliability is ever again going down wards. For example if, the probability of power supply is P, and power failure is Q then the equation holds.

$$P + Q = 1 \text{ ————— } 1.0$$

Ordinarily, P should tend to 1.00 and  $Q \rightarrow 0$ ; but what we have is Q is increasing as less and less power is available in the grid and so load shedding is on the increase because there is not human character or natural reform to improve the system.

We are however happy that some progress is going on in Nigerian Independent Power Project (NIPP) and it is our prayer that more power should be available in the grid. But where is the necessary human reform?

#### Distribution Voltage Quality

It is well know that Electric Energy, supplied to any consumer is given by the equation (3 - phase)

$$E_3 = \sqrt{3} VI \cos \theta \times \text{time} - \text{duration the power is available.} \text{ ----- } 1.1$$

For a month of 30days and 24 hours per day; if during the month power was not supplied for some days, then we can define a factor  $d_f$  for the availability of power P so that equation 1.1 can be written as

$$E_3 = 720 \sqrt{3} d_f V I \cos \theta \text{ ----- } 1.2$$

where  $d_f$  = Hours, Power was available, 720 per month ----- 1.2a.

On the other hand, the voltage at the consumers terminal is hardly ever upto 220/230 single phase (or 380/400) volts for three phase. Accordingly, another factor of voltage reduction is;

$$d_v = \frac{\text{Consumer Voltage, } V_c}{230/220} \text{ ----- } 1.3$$

as the case may, so that equation 1.2 becomes

$$\text{Energy}_3 = 286.8 d_f d_v I \cos \theta \text{ KWh ----- } 1.4$$

and for the single phase cases; it is

$$\text{Energy}_1 = 132.5 d_f d_v I \cos \theta \text{ KWh ----- } 1.5 \text{ per month of energy supply.}$$

Table 1 shows some results of  $d_f$  and  $d_{fv}$

**TABLE 1** some values of  $d_f$  and  $d_{fv}$

| S/NO. | LOCATION                  | Hr/Mnto | Hmr | $d_f$ | $V_L$ | $V_c$ | $d_{fv}$ | Remarks                 |
|-------|---------------------------|---------|-----|-------|-------|-------|----------|-------------------------|
| 1.    | Rural setting             | 720     | 373 | 0.518 | 230   | 160   | 0.7      | Rural Community         |
| 2.    | Sub/station<br>Semi-Rural | 720     | 270 | 0.375 | 230   | 180   | 0.78     | Semi- Rural sub-station |
|       | Semi-rural                | 720     | 288 | 0.40  | 230   | 170   | 0.74     | Medium Town Community   |

The supply voltage to many consumers is characteristically low, nor is the probability of supply satisfactory nation wide. Are reforms not meant to improve the existing situations? When shall we all work harmoniously to reap the rewards of reforms.

Let us all positively hope that the words of Guardian News paper (24-08-2011) that; "President Goodluck Jonathan yesterday (23-08-2011) inaugurated the Board of the New Federal Government-owned Nigeria Bulk Electricity Trading Plc(NBET) pledging to conclude all processes that would lead to generation, transmission and distribution of improved steady, stable and regular power supply in the Country" will come to stay bringing joy and happiness to all of us; and that the new era of reliable power supply has come at last. The paper continued, "The new company, popularly called "Bulk Trader" ----- is expected to buy up the power generated by the new and old generation companies (GENCOS) and assure investors of stability in the power sector.

It is a good coincidence that as I was developing the key issues in this paper, the Electric Power Sector Reform Act of 2005, was being talked about by the papers. And so the paper went on, "The Bulk Trader (NBET) is also expected to add value to the transformation of the power sector". NBET should, "act as a catalyst for new investment into the power generation market. The Bulk Trader is equally expected to stabilise the market for those already in the business especially at this time when we have embarked on the successor distribution companies of the Power Holding Company of Nigeria (PHCN)". "The President went on;" We are unfortunately faced with a situation where our power distribution companies find it too challenging to collect enough revenue from their customers to pay for Powers they received from generating Companies. In this situation, potential investors do not have the confidence that when they produce and deliver power, they will receive payment, so they will not be encouraged to invest in the sector. Our goal of generating enough power for our people may therefore not be reached. The Government has therefore incorporated the Bulk Trader as a guarantor to boost confidence in potential investors

that they be paid for power they generate and sold to the distribution companies.

The main reform now is that **GENCOS** or private generating companies are encouraged, and the Federal Government will be the main ISO (Bulk Trader) – that will sign the Power Purchase Agreements (PPAs) with the respective **GENCO-Companies**. However, the DISCOs are still there and the problem of Human Reformation is always there. And how to tackle the problem of Human Reforms has always been there. This we must settle nation wide. Indeed the human reforms as willed by **God** are man's most difficult problem: That is, he must serve God as God has willed that He, God should be served. And to do this satisfactorily man must know God's Laws, and so serve God and Mankind faithfully and accordingly.

Following quickly what has been said above, is Dr.Effiong Umoren, the newly appointed Chief Executive Officer/CEO of the Benin Electricity Distribution (BED) Company of the Power Holding Company of Nigeria (PHCN). He has this to say; " He decried the high debt profile of customers in the zone, putting the figure as ₦12.2 billion; (the Sunday Guardian of August 28, 2011 Page 7. He is quoted as complaining that the greatest challenge to service delivery is vandalism and the general reluctance of customers to pay bills on the part of the customers in the area"/zone which consists of the States: Edo, Delta, Ekiti and Ondo.

Dr.Effiong quoted vandalism occurrences as assuming alarming proportions namely:-

In 2010 over 170 cases were recorded in the Company; and Edo State alone accounting for 57 of them.

Meters are by – passed and theft of electricity through other illegalities go on and Edo State alone recorded 215 cases; and

Vandalism cases in 2011 stands at a staggering figure of 154 cases and that this is just for the first seven month of the year, 2011.

With things like these going on, how can good ever come our ways and be in the country. For in the end, good will attract good; and evil will attract evil. And where evil dominates, goodness runs away.



We are all aware that we do not have enough power from the generating stations flowing into the Grid. Because of this, we have regular load shedding, frequency/voltage reduction and power failures caused by inevitable faults, be they due to generator outages, breakdowns in transmission and distribution systems. With the new zonal reformation, the Bulk Trader (or ISO) will sell electric energy to the already existing zonal distribution Companies (also called **DISCOS**)

Recall that we have changed the name of the electricity supply industry (from Electricity Corporation of Nigeria, (ECN), Niger Dam Authority, Nigeria Electricity Power Authority (**NEPA**) to present day **PHCN** and this is being replaced now by the proposed, Independent Power Plants/Producers or (**GENCOS**) generating stations, the ISO (also called Nigerian Bulk Electricity Trading (**NBET**) PLC which will hopefully sell energy to the already existing distribution zones of **PHCN**. This is perhaps where we are now. The question must be asked: Will this latest conceptual reforms work well where others failed? Hence we must address the Human Factor in the reforms. Clearly, the human factors in reforms are not working satisfactorily. Come what may this human factor is the problem, because he is not doing as willed by God, nor as needed by the people he should serve.

Dangote produces cement. He sells to distributors who sell to ultimate customers who pay before they collect cement bags they bought. Can **PHCN** be like Dangote? Why do the Nigeria Power consumers not pay bills whilst they purchase cement (or any other commodity) and pay?

Judging by what electric energy stands for, furthering the economy, and all social/domestic systems, why are we all in one way or the other working for the eventual destruction of our nation? This is what (see before me), unless an un-known High

Hand comes most severely on the most wicked selfishness and corruption which the Nigerian minds (or our intellectual evils) have invented.

Let us pray that it will come to do a final mortal blow on these evils; for no nation has ever been built on evil, and there is too much evil in our society already.

Is there anything we of the Nigerian Society of Engineers (NSE), can do to save ourselves and the Electric Energy supply system from destruction?

Let us recap what we have said so far

- (a) Power generation is grossly inadequate.
- (b) Power Transmission networks the 330/132 KV grid is grossly unsatisfactory, but thank goodness the grid extension to new areas is on.
- (c) The Distribution networks, 33/11KV primary distribution lines and the 415/230 volts secondary distribution network are not also

satisfactory. Indeed, the wire sizes used in some cases are not up to standard;

(d) Consumers are owing billions of Naira and the distribution companies (**PHCN**) are not able to collect bills as they even admit publicly.

(e) Vandalisation of lines and other types of equipment are rampant.

(f) Allegations of corruption at low and high places are almost every where.

Indeed I had some experiences of these, way back in Jimeta/Yola in 1958 and in Bida in 1961.

(g) Electric Power stealing via illegal extensions to consumers who are never registered as consumers (not included in the list of those who do not pay bills are very many nation wide). This aspect may even need a study so as to fully account for the losses involved in Naira values. I am not aware of any study of this problem either.

(h) The quality of voltage at many consumer terminals is low. It varies through 90, 100, 150, 170 to 200 volts in many towns. This means no equipment is performing satisfactorily at the rated voltage.

(i) There is high level of irregular power supply. In some developed countries, the probability figure **P** is more than **0.998**, but we are having the figure of **0.5**. But yet bills are sent to consumers to pay as if the diversity factors  $d_f$  and  $d_{fu}$  are unity each and yet the corresponding voltage factors ( $d_{fv}$ ) is about **0.7** in certain cases.

Therefore in a consumer premises properly tested with average numerical values of the product,  $d_f \times d_{fu}$ , the bill should be multiplied by the corresponding numerical value of  $d_f \times d_{fu}$ . Hence for the cases in table 1, the factors to multiply each bill will be **0.362** and **0.2925** respectively.

From the above listing, we do have a big problem in our hands.

Note also that if these factors were higher say **0.8** and **0.9**, then the factor will be **.72**; and people will be paying high bills as it should be.

#### Vast Human Reforms

Many physical and infrastructural reforms have been failing us all since Independence. Religious organisations have grown with lips and bounds. The number of States and local governments has increased, but the most important of all reforms has not been achieved. Everything seems to have been intellectually willed; and the spiritual being of man has never been taken most seriously into account. Therein lies the greatest failure of man commonly called the **Fall of Man** (FOM): Until man comes to understand his spiritual well being and he places it above all else; peace, joy and happiness will always elude him; or us all.

All types of evil dominate man's life all the thoughts of lust, and passion, greed, hatred, envy, jealousy, and above all selfishness



manifested as corruption; all these pass through the minds of men and women. They generate the conditions of hell on earth. Thus, we as a people have refused to let go our evil and wrong doings. Corruption then is increasing. Indeed the selfishness and corruption for tomorrow because of the Law of attraction of what is similar will be more than what it is now.

Jesus Christ gave us two commandments and no one wants to obey them. Now we have the knowledge of God<sup>1</sup> on earth, but only very few people want to look into it. But in it we read about God's Creation (say the Universe) and the automatic Laws of God's Will that work in it. This unique work tells us that the human intellect is a tool of the in dwelling spirit of man. But for almost all of us the Spirit is asleep.

The whole matter was put by Christ as follows: He was talking to Mary of Bethany after his resurrection; He said; "Mary sin came to this world because human beings set their will before God's Will. Judas (who betrayed Christ) too gave priority to his intellect that caused his fall. I say to you, do not forget this experience! Whenever you live again on earth, seek to spread the knowledge, that intellect (the product of human front brain activity) should be an instrument (or tool) of the human spirit. If it is wrongly directed, it becomes as an instrument of the Devil, for the destruction of mankind". This matter is very clear for all: That each person must struggle with all his strength to strive for his own spiritual awakening (each for himself) or else he will be destroyed by the works of the Devil; untruth namely, falsehood, murder – (wars/violence and militancy) and lies upon lies as the father of it, including Hitler's time in Germany.

#### **What can we do to save ourselves/Conclusion**

All education must change, (giving the Will of God (hence the knowledge of God) the topmost and the necessary priority. We must embark on a new social system based on love for one another which radiates from the TRUTH FROM GOD. A drive for the welfare of all becomes the order of the day. Extremes of wealth and abject poverty, misery and distress shall be no more. Great and noble, sublime human beings imbued with love and pursuit of unshakeable goodness shall lead us. Corruption, and selfishness which are now almost destroying our country shall be no more. Those who perpetrate evil shall no more be in positions of authority. We have suffered enough and we shall suffer no more from wrong

evil governance nor shall there be evil followers in the years ahead. May the good Lord touch the hearts of those in power/Leadership positions or else they should step aside for the new spiritual leaders and in government who will guide us all out of the terrible prevailing conditions of poverty, misery and distress; and there will be light everywhere both material and spiritual. And the greatest struggle of all the struggles is to be good human beings is; First and foremost: Think pure thoughts only and always. In this way, nothing wrong or evil will ever develop. Thus there shall be spiritual government everywhere based on the knowledge of the Truth which encircles the Universe of which we are a part.

#### **REFERENCES**

1. ABD – RU- SHIN IN THE LIGHT OF TRUTH: THE GRAIL MESSAGE, Alexander Bernhardt 1929
2. Naisbitt, R & Aburdence, P, "Re-inventing the r Corporations, Futura, 1986
3. Wildi, T. "Electrical Power Technology", John Wiley & Sons, 1981.
4. Kuale, P. A. "Independent Power Plant Project (IPP) in Delta State (Project Conceptualization, Design and status of Implementation", Working act 2002, Conference, Asaba.
5. Shahidetrpour, H., Yahim, H., &Zuyi, Li "Market operations in Electric Power System, Book, John Wiley & Sons, 2002.
6. Dorling Kindersley, "Children's Illustrated Encyclopaedia, page 528-529; DK, London Johannesburg 1991"
7. The Scriptures, The Bible.
8. Kimbro A. and Hill, N. "Think and Grow Rich (A Black Choice" Rhema Publ. Ministry Inc. 1991.
9. Charles Hannel, "The Master Key System" Brownstone Books, Edition, 2007.



# UNIVERSE

**LARGEST EXPANSE OF SPACE** that we call the universe contains everything there is. It includes the sun, the planets, the Milky Way (and all other galaxies, too). The universe is continually expanding, and each part is gradually moving farther away from every other part. We know about the universe by using powerful telescopes to study light, radio waves, X rays, and other radiations that reach Earth from space. Light from a star travels nearly 6 billion miles (10 billion km) in a year. We call this distance a light-year. The light from a star that you can see through a telescope may have traveled thousands of light-years to reach us. The universe is made of billions of galaxies. Most scientists believe that galaxies are made out of the same material that was ejected from the Big Bang. This is called the Big Bang theory.



**ELLIPTICAL GALAXY**  
Elliptical galaxies, such as the one shown here, consist mostly of older, red-colored stars. These galaxies contain only small amounts of gas and dust from which new stars are formed.



**BLACK HOLES**  
Scientists believe that the gravitational pull is so strong that nothing can escape. This creates a black hole (shown here). As you go farther from our sun, the light gets weaker, but light from a black hole is so strong that it can be seen from billions of light-years away. Although we can't see the black hole itself, it can be seen by the brightest thing we know.



## LOOKING BACK IN TIME

If you look through a telescope, you can see galaxies millions of light-years away. You are not seeing them as they are now, but as they were long ago, when their light first set out on its journey – so in a sense, you are looking into the past.

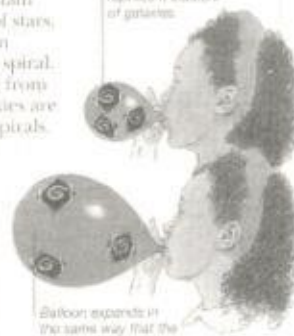
1 Galaxy is 100 million light-years away. Light left this galaxy when the dinosaurs lived on Earth.



## GALAXIES

Galaxies, which contain gas, dust, and billions of stars, belong to one of three main groups – elliptical, irregular, or spiral. Most galaxies are elliptical, ranging from sphere shapes to egg shapes. A few galaxies are irregular. Others, such as the Milky Way, are spirals. Most galaxies belong to groups called clusters, which often contain thousands of galaxies of all three kinds.

Pieces of paper represent clusters of galaxies.



Balloon expands in the same way that the universe is expanding.

## THE EXPANDING UNIVERSE

You can get an idea of how the universe is expanding by imagining several small pieces of paper glued onto a balloon. Each piece represents a cluster of galaxies. As you blow up the balloon, all the paper pieces move farther away from each other. In the same way, galaxy clusters are moving farther away from each other. The farther a cluster is, the faster it travels away from us.

## Find out more

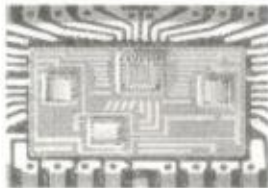
- BLACK HOLES
- COMETS AND METEORS
- EARTH
- LIGHT
- MOONS
- PLANETS
- STARS
- SUN
- TELESCOPES

Figure 3 The Universe called from Children's Encyclopaedia

# COMPUTERS

## HOW COMPUTERS WORK

A computer converts everything it handles, such as letters of the alphabet, numbers. The numbers are stored in the computer in the form of binary signals in which "on" stands for 1 and "off" stands for 0. All letters, numbers, and pictures are represented by sequences of 1s and 0s, which is called binary code. The computer does all its different tasks, such as printing a word into a document, by doing calculations with numbers. Once it has finished its job, the computer changes the numbers into words and pictures that we can understand.



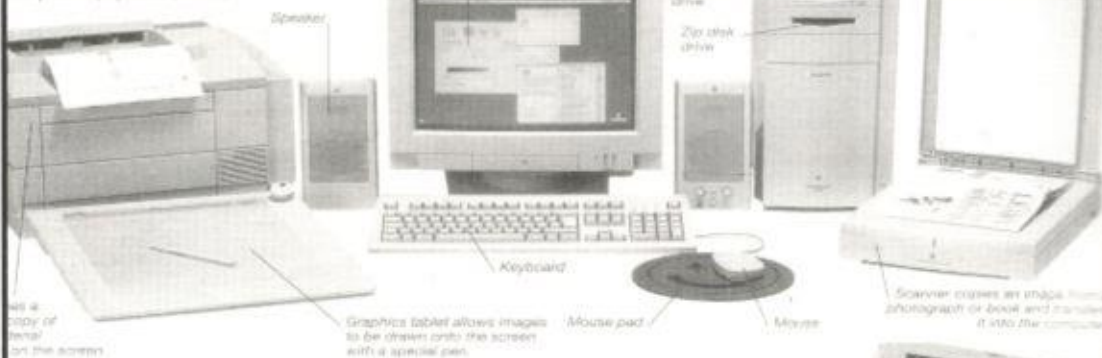
All computers contain a set of microchips (left). Inside a microchip are thousands of tiny electronic parts that store and process electronic signals.



The programs that make a computer perform different tasks are called software. A computer can perform many different jobs simply by using different software programs. From computer games and word processing packages to painting programs and scientific applications, there are many complex calculations.

## WARE

Computer machinery is called hardware. There are many different kinds of hardware: personal users, small portable computers, and large mainframe computers on which many people can work at the same time. Hardware also includes devices such as monitors, printers, and computer equipment (below).



Set a copy of text on the screen.

Graphics tablet allows images to be drawn onto the screen with a special pen.

Mouse pad

Mouse

Scanner copies an image from a photograph or book and transfers it into the computer.

## ISTORY OF COMPUTERS

In 1834, English inventor Charles Babbage designed the first programmable mechanical computer. However, he did not make the machine as it was too complex for the technology of his day. The first electronic computer, ENIAC, was built in the US in 1946. During the 1980s, microprocessors and microchips enabled computers to become smaller and more powerful. Easy-to-use software programs such as those developed by Microsoft (below) encouraged the spread of computers in people's homes. In the 1990s, web browsers opened the Internet to private individuals.



In 1975, American Bill Gates (1955-) founded the Microsoft company. By the 1990s, Microsoft was selling more than half the world's software.

## NEW TECHNOLOGY

Computers are becoming increasingly portable and versatile. They are being constantly improved and now perform an increased number of tasks on more compact hardware, such as laptop computers and electronic notepads.

This laptop (right) has a built-in CD-ROM drive and a modem. The modem allows the user to fax, email, or use the Internet via a mobile phone.



This electronic notepad is used by a doctor to record notes during a consultation.



Mobile phone plugs into the modem.

CD-ROM drive

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TECHNOLOGY

Figure 4. Computers History of Development. Called from Children Encyclopaedia



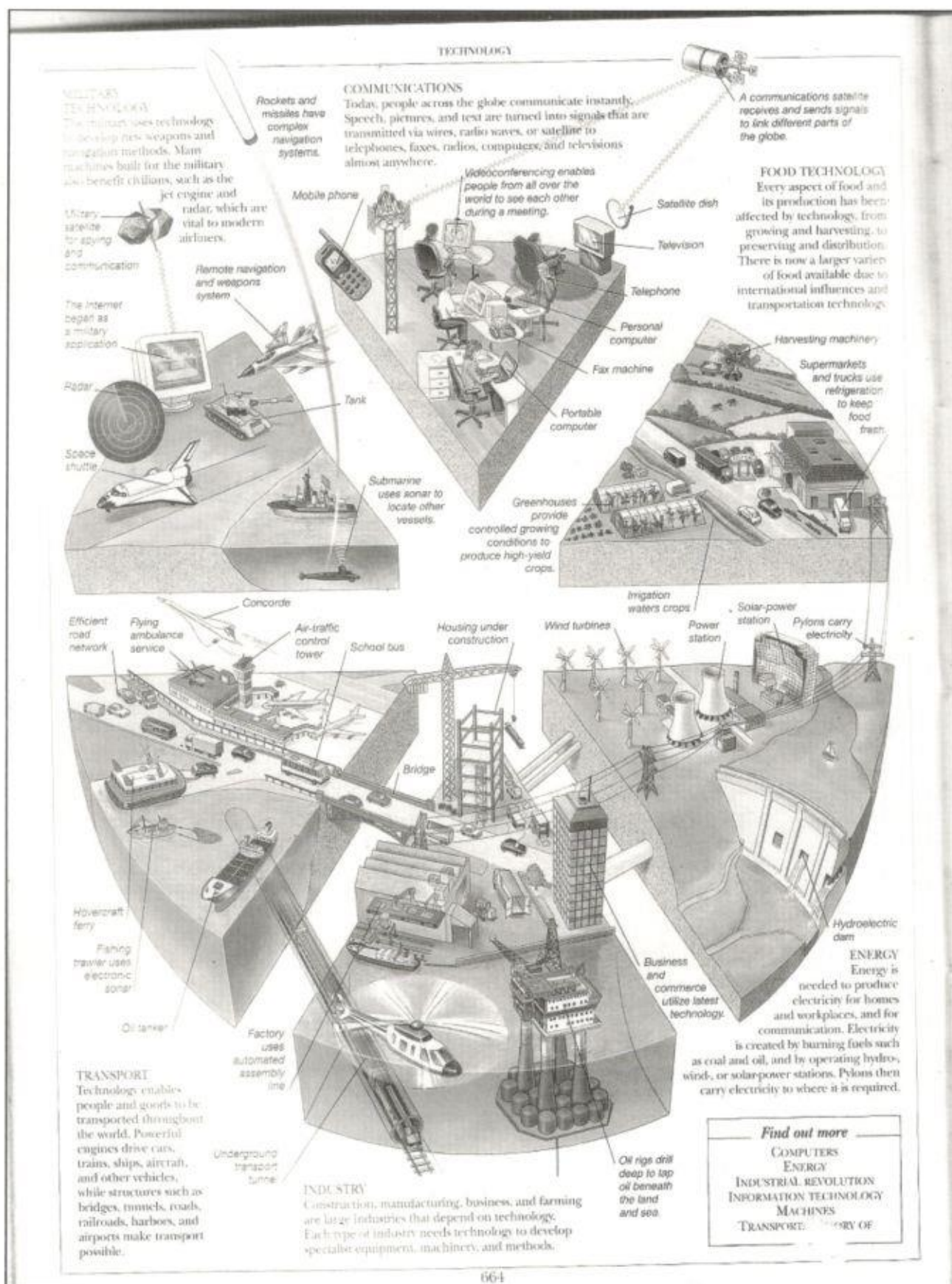


Figure 5. Technology called the Human Capital from Children's Encyclopaedia