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Research Article

Energy Depleting Resources Burgeoning Demands and Survival Expediencies

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Abstract

The fast growth in the consumptions of Energy have been generating threats by the shrinking of Resources whereas Energy happens to be the Key of Modern Civilization, and Major Input for all Economic Growths, Life & Living. On the face of declining Non-Renewable Resources i.e. Coal, Oil & Gas & Mounting Pollutions, Renewable Energy i.e. Wind, Sun, Geothermal, Sea Waves, and Hydel which are inexhaustible, in the sense that if these are not available, the very life may disappear, has been gaining importance. The Efficacies of Renewable Energy will depend largely upon Efficiencies of Conversion, Storage & Feeding the Loads, apart from the Costs & Reliabilities of Installations. The problems of Storage is closely related to Conversion Technologies eg Fuel cells, Electrolysis Cells, Batteries, Solar Cells, Polymer Fuel Cells, Thermoelectric components et al. With higher & higher Capacity Storage & Conversion Systems being available, Large Capacity Solar Plants mainly near Desert Areas with Solar Grids should get recognition, with simultaneously Standalone Systems for Residences, Offices, Workshops & Independent Networks for Arid/ Sunny areas. Added with Hydrogen Fuel, most of the Energy Demands, with commensurate R & D Programs, will be met with these two inexhaustible Resources

Keywords: *Depleting Resources, Demands, Renewable &Non-Renewable Energy Conservation. Strategies*

1. Introduction

1.1. Energy happens to be the KEY of Modern Civilization, and Major Input for all Economic Growths, Life & Living. In the case of the *Developing Countries*, e.g. India & China, the Energy Sector assumes, *all the more*, critical importance, due to the Ever-increasing Demands for Energy requiring identification of the Sources & Commensurate investments to meet them, - apart from the perpetuating *needs of Planning, Updating of Knowledge, Expertise, Innovations & identification of New Sources and Professional & Trade Skills, with due interrelationships.*

1.2. Naturally, Energy Resources, their Growth/Decline, & Development, Consumptions, Modes of Utilizations and Conservation, as also Disposals of Wastes & Replenishment/ Search for Alternatives, are matters of serious Concern and continuous Planning & Review.

1.3.The Activities such as Manufacturing and Transportation, including Railways, are basically, *Energy Intensive*, and Energy Efficiency, Energy Dependence, Energy Security and its Price, Sources apart, are naturally, primary areas of anxiety & interest, accelerated by the Economic growth Rate envisaged.

1.4. The fast increase in the rates of consumptions of Energy have been generating *lurking* threats by the shrinking of Resources & loss of symbioses; consequently, there have been Intensive Researches as to New sources of Energy, like those termed as *Renewable.*

1.5. Energy can take different forms like *Thermal, Chemical, Electrical, Radiant, Nuclear* etc. These are often grouped as being either *Kinetic Energy or Potential Energy*. Many of these forms can be readily transformed into another with the help of transforming devices, e.g. Heat & Chemical Energy to Electrical Energy. Life itself is critically dependent on Biological Energy Transformations; Organic Chemical Bonds are constantly broken, and made to make the Exchange and Transformation of Energy possible.

1.6. Meteorological phenomena like Wind, Rain, Lightning, Tornadoes etc. results from Energy Transformations brought about by Solar Energy on the Planet.

1.7. A Tropical Cyclone can. *it was estimated*, may release Heat Energy at the rate of 50 to 200 trillion Joules per day, roughly 200 times the World-wide Electrical Generating capacity per day.

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1.8. The Rance Tidal Power Plant in France - built in 1925, abandoned in 1930, rebuilt and completed in 1967, was the World's 1st Electrical Generating Station powered by Tidal Energy. The Plant has a peak rating of 240 Megawatts from its 24 Turbines with an Annual output of about 600 million KWH. on an average, about 68MW.

1.9. Over 50% of World's small Hydroelectricity Generating Capacity was in China with largest instantaneous Generating Capacity (22,500 MW). In India, Hydroelectric potential of about 15,000 MW has been identified

1.10. Petroleum products still happens to the major source of Energy, and as per one Report, constituted above 60% of total Utilization, leaving about 35% for Electricity; in India, this constituted about 40%, though 93 billion liters of Bio fuels produced Worldwide in 2009 replaced the equivalent of an estimated 68 billion liters of gasoline, equal to about 5% of World Gasoline Production.

1.11. Electrical Energy is mainly generated by Coal Thermal Plants, & Hydel Power, and some quantity is also available from Sun, Geothermal, Nuclear, Wind & Sea Waves.

1.12. Ordinary Fossil Fuel Power Plants convert between 36% and 48% of the fuel's Energy into Electricity, with the remainder being lost as waste heat.

1.12.1. Side by side, burning Biomass indoors, leads to 1.5 and 2 million deaths each year, though 10% of Energy has been coming from traditional Biomass.

1.13. Wind & Sea Waves, are intermittent; therefore for uninterrupted supply, Air compressed into special Caverns can run Turbines, even when the environment is less Windy.

1.13.1. The Solar Energy is available for a portion of the day, and interrupted by Clouds, Rain, Fogs etc. The Generation & Utilization can be enhanced by choosing locations say close by to Deserts, Higher & Higher Capacity *Conversion & Storing Devices*, eg very high Capacity Batteries where intensive research is in progress to multiply the Capacity vs Weight/Volume Ratio as also their Manufacture. Lithium Batteries have been providing answers increasingly. A Solar Grid, then only can be a reality.

1.14. The Spent fuel for Nuclear Energy is highly radioactive, and needs to be handled with great care and forethought. Whereas, Nuclear Power Stations were - so long, cheap to run but very expensive to build. It is noteworthy, France, *as reported*, had the cleanest air of any industrialized country, and the cheapest Electricity in all of Europe. Nuclear Plants are also expected to become several fold costlier. France, further, used to reprocesses its Nuclear Waste to reduce its mass and make more Energy.

1.14.1. France and Lithuania were getting more than 70% of their Energy requirement from Nuclear power, while Slovakia, Belgium, Sweden and Ukraine were obtaining more than 50% (*Source : IAEA, Vienna).* While Nuclear Power provided over 16% of the World's Electricity(Source: World Nuclear Association); 'the IAEA projection assumes that No New Nuclear Power Plants are built beyond what is under construction or firmly planned today, and Old Nuclear Power Plants are Retired on schedule. Nuclear Electricity Generation in this projection grows to just 3 100 TWh in 2020 (1.1% growth per year) and remains essentially unchanged in the period to 2030' (World Energy Council).

1.14.2. Nuclear Waste is a difficult Political problem which to date, no Country has solved totally. Nuclear Power, it is argued, is a sustainable Energy Source that reduces Carbon Emissions, increases Energy Security *by decreasing dependence on Oil*, as also offers, *comparativel*y, less risks of storing waste; the Operational Safety record is also good compared to the other major kinds of Power Plants.

1.14.3. Nuclear Power, the Critics claim, is a potentially dangerous Energy Source, and has the problems of storing Radioactive Wastes, possibilities of severe Radioactive Contamination, by Accident, or Sabotage, & Terrorism by its use as a Weapon, Nuclear Proliferation, and the disadvantages of Centralized Electrical Production cannot be ignored, either. In December of 2007, German Children, a study showed, living near Nuclear Power Plants, had a higher rate of Cancer, though there was no extra radiation near the Nuclear Power Plants. Fukushima &Chernobyl Nuclear Accidents had added to the anxieties.

1.14.4. In india, a three stage Nuclear Power Scheme consisting of Pressurized Heavy Water Reactors (PHWRs), Fast Breeder Reactors (FBRs) in the second stage and Reactors based on Uranium233 – Thorium232 cycle in the third stage, have been adopted.

1.14.4.1. Within 10-15 years, a Generating Capacity of 40,000-50,000MW of Nuclear Power is expected & b*y 2050*,. the planned six reactors would produce a total of 9,900 megawatts of Electricity.

1.15 The increase in Fossil Fuel Emissions from *Car, Aircraft, Industry, Coal, Firewood, & other sources*, as also massive Pollutions from Sewages, Refuses, & other Toxins, Rise in Temperature et al, have been *multiplying* imbalances in the Ecosystem, - its Crumbling & Decadence *apart*, and contributing to the Ecological Destructions.

1.15.1 In the last two hundred years, 60% of all World Resources have, already, been consumed.

1.15.2 According to one estimate, humans have been consuming 40% more than what the Earth can sustain *and there are* just 10 years *–reckoned from 2007*, to save the World.

1.15.3. The Bio-invasions by Greenhouse Gases exacerbated by building in CO_2 - 14,000 times faster than Nature, highest in 420.000 years, and doubling every 15 years, have been continuously multiplying

1.15.4. The emissions of heat-trapping gasses has increased by 70% between *1970 & 2004, and that of*

Carbon dioxide that acts like heat sink, by 80%. The CO2 *emission in 2009 was* 209 gigatonnes. Methane gas locked in the Arctic permafrost and seabed, has been bubbling from Underwater vents, & escaping in massive amounts to Northern sky, adding to Global Warming by another 7 degrees, even may spell Climatic Catastrophe; *in 12 years, Earth may have to face major meltdown' of Ice.*

1.15.5. Earth is warming up steadily since 1970; the Sea *level may further, rise by 19 – 23 ft due to melting of Greenland & West Antarctic ice sheets, , it is blowing hot in Antarctic even in some zones of Himalayas at 41 degrees C.* The Glaciers of Mexico have been melting down, slowly to *oblivion, creating the threat for an ice-less North Pole and subsequently South pole by 2022.*

1.15.6. It is further apprehended that the 30 % of habitable lands may turn to Deserts affecting 20 millions of population in 110 countries, apart from Drying up of 10 major Rivers; then there are Disappearing Coral Reefs & thousands of Species, Dwindling Forests Mounting shortage of Food & Drinking Water etc. (Author's Article Published in the International Journal of Thermal Technologies' USA in August 2013)

2. The Energy Spectrum

2.1. Energy, for easy conceptual understanding, is usually classified, in three categories, based on three different criteria:

2.1.1. Primary and Secondary Energy,

2.1.2. Commercial and Non-commercial Energy,

2.1.3. Renewable and Non-Renewable Energy.

2.2. Primary Energy sources are either *found or stored in Nature like* Coal, Oil, Natural Gas, and Biomass (such as Wood); Other Primary Energy sources include Nuclear Energy from Radioactive substances, Thermal Energy stored in Earth's interior, and Potential Energy due to Earth's Gravity.

2.2.1 Primary Energy like Coal, Oil or Gas are converted into *Secondary Energy like* Steam and Electricity in Industrial Utilities.

2.2.2 Some Energy sources may also have Non-Energy uses, like Coal or Natural Gas being used as a *feedstock* in the Fertilizer Plants.

2.3. The Energy, like Electricity, Coal, Natural Gas Petroleum Products etc., sold in the market, are known as Commercial Energy - the basic Energy sources in Industries, Agricultural, Transport, Education and Commerce, as also in Households.

2.4. Non-Commercial Energy

2.4.1. Non-Commercial Energy are not available in the Commercial market, and include Traditional fuels such as Firewood, Cattle Dung and Agricultural Wastes, which are gathered, and used especially in rural households – though, in small quantity, may also be sold in the local markets.

2.4.2 Solar Energy, though it has an installation price, are usually not sold, and used for Water Heating, Electricity Generation, Drying Grain, Fish and Fruits.

2.4.2.1. Solar Energy, if produced in mass scale, with commensurate Storing device, Solar Grid & Distribution network, of course, can be sold, like the usual Electricity.

2.4.3. Animal Power for Transport, Threshing, Lifting Water for Consumption & Irrigation, Crushing Sugarcane as also Wind Energy for Lifting Water and Generation of Electricity are also not Commercially available.

3. Renewable and Non-Renewable Energy

3.1.Renewable Energy is the Energy obtained from sources, like Wind, Sun, Geothermal, Sea Waves, and Hydel which are inexhaustible, *in the sense* that if these are not available, the very life may disappear. In India, the installed capacity from Solar, Biomass & Wind was around 92,200 MW constituting about 7.3% of total Generating Capacity.

3.2. On the face of declining Non-Renewable Resources & Mounting Pollutions, Renewable Energy has gained very high importance.

3.3. Non-Renewable energy is the *conventional fossil fuels* such as Coal, Oil, Gas. and other fossil fuels, which have taken millions of years to form, & are likely to deplete soon. Coal had been providing 25% of Global Primary Energy and generating 40% of the World's Electricity.

4. Reserves of non-renewable energy

4.1. Coal, Oil, and Natural Gas had provided 79.6% of primary energy production during 2002 (in million tonnes of oil equivalent (mtoe)) (34.9+23.5+21.2).

4.2. Levels (proved reserves) during 2005–2007

- Coal: 997,748 million short tons (905 billion metric tonnes), 4,416 billion barrels (702.1 km^3) of oil equivalent
- Oil: 1,119 billion barrels (177.9 km^3) to 1,317 billion barrels (209.4 km^3)
- Natural gas: 6,183–6,381 trillion cubic feet (175–181 trillion cubic metres), 1,161 billion barrels (184.6×10^9 m^3) of oil equivalent.

4.3. Flows (daily production) during 2006

- Coal: 18,476,127 short tonnes (16,761,260 metric tonnes), 52,000,000 barrels (8,300,000 m^3) of oil equivalent per day
- Oil: 84,000,000 barrels per day (13,400,000 m^3/d)
- Natural gas: 104,435 billion cubic feet (2,963 billion cubic metres)19,000,000 barrels (3,000,000 m^3) of oil equivalent per day (Source Wikipedia)

4.3.1. The demand on OIL – with, anticipated 3 billion vehicles, may increase to 360m barrels in 2020, whereas the *production of Fuel - with a peak between 2004 & 2008, had reportedly fallen* to 52.m barrels/day by 2012, and to *17.5 by 2050.* (Source Hazen, Mark E :*Alternative*

Table 1 The Electricity Consumption around 600TWh in 2009 is set to double by 2020

Commercial Energy for Final Consumption (BAU SCENARIO)					
Source	**Units**	**1994-95**	**2001-02**	**2006-07**	**2011-12**
Electricity	Billion Units	289.36	480.08	712.67	1067.88
Coal	Million Tonnes	76.67	109.01	134.99	173.47
Lignite	Million Tonnes	4.85	11.69	16.02	19.70
Natural Gas	Million Cubic Meters	9880	15730	18291	20853
Oil Products	Million Tonnes	63.55	99.89	139.95	196.47
Source: Planning Commission *BAU:_Business As Usual*					

Energy : An Introduction to Alternative & Renewable Energy Sources).

4.4. With ever increasing Consumptions, & at a 5% growth per annum RESOURCES available have fast been depleting and might be coming down to
Coal: this would be reduced to 45 years, or until 2051, provided the Human beings survive
Oil: current oil reserves could be completely depleted by the year 2050
Natural Gas: less than 50 years

5. Energy Consumptions

The Electrical Power Consumption Worldwide was about 16 tera KWHs

5..1In the Railways, the share of Traction Power vs National Generating Capacity is in the Order of 2% The Energy out of Regenerative Braking will be dependent on the Momentum at the time of Braking & no of Brakes applied - obviously marginal, but Technically Meaningful.

5.2. At present, about 85% of Primary Energy comes from non-renewable, Fossil sources (Coal, Oil etc.). These Reserves are continually diminishing with increasing consumption, and may not at all exist for future generations.

5.3. The per capita Consumption of Electricity in India was 612.5 kWh (kilowatt-hours) in 2004/05.The Plant Load Factor of Thermal Power Stations in the Country was 73.6%. - a marginal decline of 1% from the previous year.

5.4. With the anticipated Economic Growth of 8%–10%, through 2031/32, may require, at the very least, an increase in Primary Energy Supply by three to four times in India.

6. Renewable Energy

6.1 With the declining Resources, Renewable Energy, though *fluctuating by nature*, obviously, happens to be the thrust area, and is obtained from *ostensibly* inexhaustible sources, like Wind , Solar , Geothermal, Tidal and Hydel. Hydrogen fuel should also figure These would also bring down the threats from harmful pollutants The Efficacies of Renewable Energy will depend largely upon Efficiencies of Conversion, Storage & Feeding the Loads, apart from the Costs & Reliabilities of Installations. The problems of Storage is closely related to Conversion Technologies eg Fuel cells, Electrolysis Cells, Batteries, Solar Cells, Polymer Fuel Cells, Thermoelectric components et al.

6.2. During the day, the Air above the land heats up more quickly than the air over water. The Warm Air over the land expands and rises, and the Heavier, &Cooler Air rushes in to take its place, creating winds. At Night, the Winds are reversed because the Air cools more rapidly over land than over Water

6.2.1. The proportion of Wind Power till March 2012 was 21760/225029 i.e about 9.6% that too after including Renewable sources.

6.2.2. The Sources are basically in the Coastal Regions and the scope of their direct uses in Railways obviously will be limited.

6.3. At the end of 2011 the Photovoltaic (PV) Capacity Worldwide was 67,000 MW, and PV Power Stations are popular in Germany and Italy.

6.4. The World's largest Geothermal Power Installation is the Geysers in California, with a rated capacity of 750 MW, an insignificant quantity

6.5. Ethanol fuel from Sugarcane, now provides 18% of the Country's Automotive fuel in Brazil; Ethanol fuel is also widely available in the USA.

6.6. As of 2011, small Solar PV systems provide Electricity to a few million households, and Micro-Hydro configured into Mini-Grids serves many more.

6.7. Over 44 million households use Biogas made in household-scale digesters for lighting and/or cooking, and more than 166 million households rely on a new generation of more-efficient Biomass Cook Stoves
6.8. Nevertheless, looking to the Climatic Changes & Shrinking those have been taking place, and inadequacies

in restraints all over to resist these, it may be too much of optimism to expect the Renewable Sources, other than Solar & Hydrogen to remain as it is today.

6.9. 'Solar Power Generators may produce most of the World's Electricity within 50 years, dramatically reducing the emissions of greenhouse gases that harm the environment'

6.10. As per the contemporary studies the contribution of Renewable Energy Sources in million tonnes of Oil equivalent (Mtoe) to the World Energy supply upto 2040 may be as follows (Source: European Renewable Energy Council).

Biomass10801313 1791 24833271
Large hydro 222,7 266309 341 358
Small hydro9,519 49 106 189
Wind 4,744266 542 688
Photo Voltaic 0,2 2 24 221 784
Solar Thermal 4,115 66 244 480
Solar Thermal Elcty 0,1 0,4 316 68
Geothermal43,286186 333493
Marine 0,05 0,1 0,4 3 20
(Tidal/Wave/Ocean)ot
al RES 1364

6.10.1. If the Growths, as tabulated, ut supra, are reached, Renewable Energy Sources may have a share of nearly 40 % by 2040.)

6.11. It is intriguing that Hydrogen Fuel Cells does not figure in the projection. 'Hydrogen will be the most important Energy Source of the 21st Century' Fritz Vahrenholt was quoted.' Long term it will replace Oil & Gas'

6.11.1. Hydrogen fuel, as per current developments, can provide Motive Power for Cars, Boats and Airplanes, as Onboard Fuel by Portable Fuel Cell or Stationary Fuel Cell applications, and can power an Electric Motor. With regard to safety from unwanted explosions, Hydrogen Fuel in automotive vehicles is at least as safe as Gasoline & Eco-friendly except for a small amount of Nitrogen Oxides.

6.11.2. With the present pace of Developments, Hydrogen fuel can provide Motive Power in Railways with Fuelling points distributed as being done for Diesel.

6.12.Biomass (Plant Material) is taken as a renewable energy source as the energy it contains comes from the sun; by Photosynthesis, Plants capture the Sun's energy. When the Plants are burnt, they release the Sun's energy they contain.

6.12.1. Biomass functions as a sort of natural battery for storing solar energy. As long as Biomass is produced sustainably, with only as much used as is grown, the battery will last indefinitely.

6.12.2. .In general there are two main approaches to using Plants for Energy production: Growing Plants specifically for Energy use (known as first and third-generation biomass), and using the residues (known as second-generation biomass) from Plants that are used for other things & vary from Region to Region according to Climate, Soils and Geography.

6.13. Clean Energy basically refers to LPG for use mainly in Autos and no ready Data as to its share in the total Energy is available and as per the records those could be located, looks to be insignificant.

7. Conservation of Energy

7.1. The concept first emerged in USA & Japan in 1973 and in the following two decades, 40% &31% Energy needs, it was claimed, could be conserved.

7.1.1. In India, a conservation potential of about 23% has been identified.

7.2. On the face of somewhat, forced growth in all round demands of Energy, the concept of Conservation, somehow, looks to be a dichotomy, unless a Review of every growth, Technically, is made, beforehand.

7.3. For Sustainable Development, as also our responsibility to our Progeny – to Generations & Generations to come, Energy Efficiency & Performance Proficiency Parameters which *in any case*, remain to be the Uncompromising Objectives in any Planning & Engineering, have however, should be given the right importance.

7.3.1. In fact, there may be hardly, any meaning to an Engineer, in drawing a line between Energy Conservation and Energy Efficiency, as Optimization. In quantitative terms always remains to be the innovative & deciding factor.

7.3.2. A Culture - an Alertness, nevertheless, must develop - in *preventing Wastages & Misuses*, like Turning off *unnecessary* Exterior Lighting in day time, Heating Systems. Cooling Systems. Other Lighting. Lifts, Water Fountains, Personal Computers. Personal Appliances, Copiers, etc. when not required/ in use.

7.4. The Features which usually, instigate the concept of Energy Conservation, are analyzed below;

7.4.1 (Lack of)Vision, Knowledge, Functional Routines, Discipline, Awareness & Objectivity: these are essential complements of any Planning, Layout, Designs & Specifications – all focused on the objectives/requirements/performance,- of course the overall Engineering and need appropriate Education & Expertise. Grass roots participations with well defined Tasks & Accountability, rather than a *Propaganda*, are essential complements.

7.4.2. The very Taxation structure, usually referred to, is Artificial & Cumbersome; no Planning, Design & Specification can be, rather should be guided by the Tax

Structure where overall Engineering & Objectivities, on long term basis, - including Life Expectancy, should only be kept in view.

7.4.2.1. It is the Tax Structure that should be rationalized to be conducive to Growth, and incidentally, Single Taxation Structure adopted.(Author's Articles 'Reckless Life', published in the 'Indian Currents', New Delhi &'Inverse The Decivilizing of The Civilization' in International Journal of Multidisciplinary and Current Research (IJMCR)USA) .

7.4.3. There is hardly any meaning, either, in looking at Market & Economic Distortions and Financing, which are, in any case volatile & areas of opportunism, as the Developments are proposed, only when it is required, and the prerequisites are, positively made available.

7.4.4. It is the basic requirements of Engineering to pay due attention to, Specification, Drawing, Standardization Layout etc., & of course, due Interrelationships & Harmony between the Objectivities, Norms, Construction & Maintenance Practices, and different Appliances, where used; similarly the exact Demands should be duly evaluated.

7.4.5. The concept of Conservation only reflects some kind of sophistry eg to excogitate savings by rearrangements in the cost in lighting, after installing it - according to some kind of expectations, and give a publicity. The Energy Efficient Appliances, like Compact fluorescent lamps (CFL) requiring 85 per cent & Halogen lamps, 40 per cent less energy, & generally lasting two to four times longer, efficaciously, may be chosen for new installations, - even for premature replacements. The thumb rule of 80/20 i.e. to gain 80% saving with 20% input is also followed.

7.4.5.1. The same principle may be kept in view, for all other Equipment/ Machinery, in use. In any case contemporary Techniques & Appliances should be used. .

7.4.6. The other areas which are relevant – and in any case kept in view during Planning, are Improvement of Power Factor, Energy Efficient Motors, Soft Starters, Variable Speed Drives and Efficient/Effective Lighting System, Optimization in Electrical Arc, Induction Melting and Heating Furnaces, Efficient Boilers & Furnaces, Steam Utilization and Condensate Recovery, Up-gradation of Thermal Insulation, Captive Power Generation, Waste Heat Recovery and its Utilization, Cogeneration, Compressors, A/C system, DG sets, Cooling Towers, etc.

7.4.7. The paces of Developments have been very fast over couple of decades and it is extremely important to update the knowledge & expertise of all tires, continuously, whereas, it is extremely important to utilize duly the expected Service Life of every Equipment .

7.4.7.1. Hardware, like Microprocessors & associated Software, are now inherent ingredients of every Equipment, and in-house expertise is a must.

8. Exigencies for a Balance

8.1. A Balance between the Demand & Supply, if required, by some regulations may be needed to exercise control on say Air-conditioners, Superfluous Lighting & Loads etc., apart from developing an Awareness.

8.2. No Planning, nevertheless, should be done on such Marginal reliefs, and Generation Capacities must be augmented, in advance in commensurate with the protected Demand, to obviate Load shedding & their spurts, and disruptions thereby. The rationale should be duly identified in the inter alia, design & layout of the Transmission & Distribution Systems, without giving undue weight to cost & pressures.

8.3. The Recourses those are adopted to obviate Load Shedding are also dearly for the Nation; the Industries, in such case, have to provide costly Standby

9. Strategies for Planning

9.1. France ostensibly, can be taken as Model as also an Expedient for Nuclear Power Generation, but a Scientific assessment is needed as to the reasons for the apathy seen World Over.. The Cost of Installation, in any case, should not be the deciding factor in an issue of so much of importance-practically, second to none.

9.2. Wind Power & Tidal Waves as also Hydel Power wherever efficacious should be duly exploited. With the mounting Eco-Destructions & consequently Climatic Changes, projected in para 1.15, the increasing Dependencies on Wind, Hydro, Tidal Wave/Ocean et al, may not be efficacious..

9.3. Hydrogen Fuel Cells have a great potentiality in solving the major problems simultaneously, and it may be conducive to intensify the Research Programs to make it a viable alternative for Cars, Boats and Airplanes etc. as also resources like Ethanol fuel from Sugarcane whose productions have to be multiplied.

9.4. Thermal Plants, though much cheaper, can produce, in India alone, 130 mt of Carbon dioxide/ year, & should be located in thick green belts, and contribute to forestation.

9.4.1. It is a relief to find a recent innovation that captures & stores the released Carbon dioxide, in the Power plant itself and should be liberally annexed. Clean Coal, as a a rule, should be used in all Coal based industries.

9.5.The Objectives behind the recourses of Energy Management & Audit Financial & Project Management, Energy Efficiencies in Thermal Electricity, Performances of Equipment and Utility Systems, Boiler etc. will be automatically be monitored in the in routine daily Routines & Maintenance schedules.

9.6. The available Clean Fuels are LPG (Liquefied Petroleum Gas), Biogas, Kerosene, and Electricity. Of these, Electricity is relatively expensive form of Cooking

Energy. Also, all these fuels, with the exception of Carbon-Neutral Biogas, cause some pollution in the kitchen. .

9.7. With Higher & Higher Capacity Storage & Conversion Systems being available, Large Capacity Solar Plants mainly near Desert Areas with Solar Grids should get Topmost Priority, with simultaneously Standalone Systems for Residences, Offices, Workshops & Independent Networks for Arid/ Sunny areas.

9.7.1. Added with Hydrogen Fuel, most of the Energy Demands, with commensurate R & D Programs, will be met with these two inexhaustible Resources.

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