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Planning and Design of Green Village

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Abstract - The Real India lies in the 7, 00,000 villages. If Indian civilization is to make its full contribution to the building up of a stable world order, this vast mass of humanity that has to be made to live again. It is recognized many times, that one of the main causes of Indian's lack of progress in the rural areas is the inadequate and unreliable electricity supply, modern energy services, water uses and waste management. No non-traditional productive activities are possible without them. The record of the last fifty years of rural development, therefore, reinforces the special relevance to Gandhiji's vision of self – reliant villages.

Green village is a process that can keep a village attaining sustainable development. It is also the habitat on which human being can live with pleasant environment. Effective and efficient planning of green village is main consideration for its maximum benefits. Aim of designing and planning is based on its energy conservation, efficient transportation, biodiversity, waste management, watershed management, rain water harvesting structure, on conventional resources.

In present work an attempt has been made to reveal feasibility of use of Green Village. Under this work detailed studies will be conducted for analyzing the problem of rural area(i.e. Case study of Palse Village). The concept of green village seems to be the best solution for many problems of rural areas.

Key Words - **WTP, STP, BGP, SES, SWMP**

I. INTRODUCTION

Mahatma Gandhi, the Father of the Nation, said that "India is in villages". "If villages perish, India perishes". Therefore, village ecosystems need a closer study emphasizing on the interactions between societal needs and life support systems. A village, being a typical unit of rural India, can be considered as an ecosystem taking into accounts its distinctive structure and function**.**

A Village which can be planed and designed by proper management and using natural resources like solar energy, wind energy, and other non-conventional resources. With every square kilometer of the rural area transmigrating into urban pockets (satellite towns).

Providing basic amities like power, water, primary health centers, educational centers, good roads, communication facilities need regular governance from local bodies for sustaining the mission.

The function of a green village mainly depends on the major bio-productive systems such as agricultural lands, grasslands, forest and wetland, which together form important physical resource base. In developing countries like India, the rural sector with high population density and high level of poverty poses a serious threat to the environment. Degradation of the environment is closely related to the pattern of resource use which is influenced by population level, migration pattern, market access and land use practices.

A green village is a human settlement that enables its residents to live a good quality of life while using maximum natural resources. It has successfully solved environmental problems including poverty, poor environmental management and wasteful production and consumption methods.

II. CONCEPT OF GREEN VILLAGE

A green village is a village which can be developed economically & by using natural resources like solar energy, wind energy etc without affecting the natural environment.

Concept of green village contents following points from environment science and engineering journal.

i) Water Supply: Community rain water harvesting with protected storm water drainage leading to storage pond will help to recharge the sub soil water table /fresh water aquifers.

ii) Sewage Treatment and Disposal: Villages with toilets are symbols of civilization, individual toilets for homes or group toilets for communities can support for health and hygiene among the users and will help to prevent water born diseases.

iii) Energy Recovery: The biological sludge generated from the 150 KLD treatment plant will be around 6 KLD, which after anaerobic digestion will be able to generate about 42 m3/day of Bio-Gas.

iv) Reuse of Treated Sewage : Approximately 2000 trees can be planted in an area of 10 acres and irrigated using 150 KLD of treated sewage.

v) Solid Waste Management: A village with 1500 population will be able to generate around 250 Kg/day of solid waste. About 70% of the waste will be organic in nature and can be suitably composted to generate at least 50 Kg/day of manure.

vi) Rain Water Harvesting: Rainwater is the ultimate source of fresh water. The activity of collecting rainwater directly or recharging it in to the ground to improve the groundwater storage in aquifer is called as Rainwater Harvesting.

vii) Green Village Power Requirement: It is estimated that for a small home of 5 persons, the power consumption will be around 2.0 Kwh/d and for 300 homes, the total power requirement will be 600 Kwh/d. Considering the power consumption for household appliances like Grinder, Mixer, Iron Box, TV, etc. the total power requirement for a population of 1500 persons will be 750 Kwh/d.

viii) Reducing the Power Consumption: Use of CFL Bulbs will reduce the lighting energy consumption by 33%.

For a population of 1500 living in 300 homes, this account to a total saving of 30 Kwh/d. The good news is that already certain villages in Sivaganga district of Tamilnadu have replaced the old incandescent street lamps with CFLs and saved more than 50% of their power bills. New generation lamps like LEDS and LVDS have a promising future due to higher energy efficiency.

Description	Incandescent Lamp	CFLs
Life	500 hours	8000 hours
Luminescence	600 Lux (40 Watt)	900 Lux (11 Watt)
Cost	Rs. 15 per lamp (40 Watt)	Rs. 85 per lamp (11 Watt)

Table1*.Comparison between incandescent & CFL lamps*

ix) Power Generation and Distribution : The sun produces about 5000 horsepower of 'free' energy per surface acre. Centralized Solar Power generation unit with 0.5 Mega Watt(500 kW) capacity will meet the power requirement about 1440 Nos of Multi-crystalline silicon photovoltaic panels with 125 watt power, will be required. These panels will be spread over an area of 2000m2. The approximate market cost of panels will be around 2.5 Crore and remaining accessories around Rs. 1 Crore. Subsidies on solar products will reduce the burden on capital investment.

x) Funding the Project: : Capital investment by government with people's contribution to Ragiv Gandhi Drinking Water & Solid Water Management Programmes & execution certified professional bodies can lead to successful implementation of the concept. Financial institutions can support these ventures at nominal interest. Cooperation from industries too can be substantially helpful to speed-up the implementation.

xi) Watershed development : Watershed development projects are designed to harmonize the use of water, soil, forest and pasture resources in a way that conserves these resources while rising Agricultural productivity, both through in situ moisture conservation and increased irrigation through tank- and aquifer-based water harvesting.

2.1 Government schemes : i) Adarsh Gaon Yojana ii) Gram swachata iii) Watershed development programme iv) Rajiv Gandhi grameen vidyutikaran yojana v) Jalsandaran

III. AREA STATEMENT: (PROPOSED SITE - PALSE VILLAGE)

Palse village is situated near Nasik –Pune highway at 15km from Nasik city. It is situated on the bank of Darna River. It is established in year 1105. The area of village is 1170 hect. & 90% of land is fertilized land. Out of 1758 families, in minimum 1000 families per person doing the job. Climate in Palse village is cool. As it is situated near darana river there is no scarcity in village. Total no. of K.T. Weir are four in Palse village.

Sr. no.	Description	Area in Ha
1	Total geographical area	1170
2	fertilized land	1015
3	Area under irrigation	66
4	Forest land	70.03
5	Pasture land	6.75
6	Unused land	92
7	No of functioning wells	594

Table 2. *Area statements of Palse Village*

IV. PROBLEMS IN PALSE VILLAGE

i) Sewage waste disposal : There are about 1800 families living in the Palse village.as per NABARD report,70% losses have provision for water closets and about 80% of houses are having bathroom with wall of 1.5m heights, remaining houses there is no provision for bathroom. Actual survey of villages during July 2009,it is observed that only 25% of houses are having water closet in use. This is indicates that proper awareness for constructions and use of wc/bath is necessary. The sewage is disposal in septic tank and finally dispose off in Darna river which causes water pollution. Public toilets are not maintained and cleaned therefore, peoples are not willing to use the public toilets thus peoples are using road sides for excreta Disposal and are causing unhygienic conditions. The unhygienic environmental in the villages have caused epidemics of gastro, joindias in year 1960, 1990 &2000.The drainage is directly disposal in river. There is no treatment on sewage water, due to this river get polluted.

ii) Water distribution : In village there is lack of maintains & cleanness of water distribution system. The pipe line.& water tank is about 30years old due to that the problem regarding leakages of pipe line, bursting of pipe, corrosion etc occurs. In village there is 40 liter water tank which is not suitable for future increase in population.

There is improper distribution of water in the families of village due to improper slope of water distribution pipe line.

iii) Industrial problem : As the sugar cane factory, Parle biscuits, Bombay bottle cleaning factory are near the village ,waste from the factories is directly disposed in the river, due to this river water get polluted. Also it causes the air pollution due to the harmful smoke from the chimney.

iv) Load shedding : In this village the load shedding is about 6 hour in village & 10 hour in farming area. It is major problem in this village.

v) Climate change : Change in rainfall pattern shift in setting in / withdrawal of summers- winters and temperature shifts in the agro-eco systems will affect cropping patterns.

There is no adequate water supply, no effective sanitation system, improper solid waste management & overall cleaness.Thus unhygienic condition leads to epidemics such as joindias, cholera, gastro etc so there is need for providing green village.

4.1 Proposal for green village

To develop Palse village as green village following works are required to be undertaken.

i) Providing water treatment plant. ii) Providing sewage treatment plant. iii) Providing watershed development iv) Bio-gas plant v) Non conventional resources

V. DESIGN, OBSERVATIONS

AND RESULTS

Year	Population
2011	17385
2021	24721
2031	30412
2041	38497

Table 3. *Population forecasting by Geometrical increase method*

A) Design of water treatment plant :

Source-1.Open well 2.Jack well at Darna river.

1.Rising main- a) length-2km b) Static head 19.5m c) diameter-175mm Provide pump of 25 H.P

2. Cascade aerator : a) Outer diameter: 2.1m b) Steps : 4 c) Rise: 0.5m 3. Flash mixer-

a) Impeller diameter: 1.57 m b) Providing size: Depth 6.6m , B 0.014m

4. Clariflocculator- Influent diameter: 0.2m

5. Flocculator- Tank diameter: 4.5m

6. Rapid sand filter- Provide 2 filter unit each of 5.33 x 4.10 x 3.35m

B) Design of sewage treatment plant:

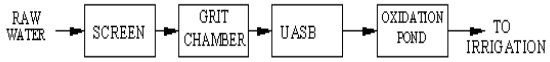

Fig. 2. Typical layourt of Sewage treatment plant (STP)

1. Bar screen: i) Size : 0.4 x 0.328m ii) No. of bar : 2 number

2. Grit chamber: i) Depth: 30cm, width: 21cm ,slope: 1in 2000

3. Primary settling tank:i) Diameter: 9.21m , depth: 3m

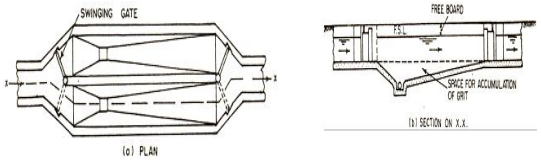

Fig. 3. Plan and cross section of grit chamber

C) Reuse of treated sewage (waste) water:

i) There is nothing like waste water in this world. One community's waste may constitute apart of another water supply The ultimate goal of water management is the maximum economic use of the total water resource. More than 99% of sewage is mere water that is polluted by the 1% impurities with all the evil attributes. Hence, water is the most abundant component of the waste water to be put to reuse.

ii) Recreational reuse: Treated sewage can be conveniently used for boating, fishing, lawn watering, gardening and other recreational purposes.

iii) Civic/ Municipal reuse: Sewage can also be used for cleaning of sewers, solid waste compaction, lawn watering and gardening.

iv) Ground water recharge: Treated effluent can be use to recharge the ground water. Surface spreading, percolation tank, and injection wells are the methods of recharging.

v) Agricultural reuse: Given layout is surrounded by the agricultural farms hence treated effluent can be used for agricultural activities. Irrigation and development of greenery can be largely benefited by treated sewage due to the micro nutrients like N, P, S, minerals, salts etc. present in treated effluents.

vi) Domestic reuse: Where water scarcity is acute, the treated waste water may be given further treatment (often called tertiary treatment) to make it potable .Even today many places treat sewage water reused it for domestic purposes including drinking.

vii) The effluent water is after use for irrigation purpose for sugarcane.

Relation between duty and delta for crop of sugarcane

Volume of recycle treated water = 2MLD =2 X 10^3 m^3

Delta = 120 cm (including evaporation + percolation losses)

B = 300 days , Duty = 864 x B/ D cm, D = 864 x B / Delta , D = 864 X 300 / 120 , D = 2160 ha / cumec

Area= Duty x Discharge =2160X2000ha =4.32X10^6 ha =10.8x10^6 Acre

Irrigated area required for sugarcane=1.728x10^9 ha/cumec

D) Design of solid waste composting plant :

i) Provide 30 compost pit each of size 4x2x1.7m

Fig. 1. Typical layout of WTP

ii) Total area required for compost plant including all element=1hect

iii) Water requirement: 6.95 cubic meter

iv) Compost produced: 1727.23 tones per year

E) Design of bio-gas plant :

(a)	KVIC Floating Drum Type Biogas Plants having digester made of bricks or stones.	1 to10 cubic m
(b)	KVIC Type Biogas Plants with Ferro cement digester	1 to10 cubic m
(c)	KVIC Type Biogas Plants with Fibre Glass Reinforced Plastic (FRP) Gas holder	1 to10 cubic m
(d)	Deenbandhu Model (i) Brick masonry (ii) In ferrocement with in-situ technique	1 to 6 cubic m
(e)	Pre-fabricated RCC fixed dome model	2 & 3 cubic m
(f)	'Flexi' model Bag digester type plant made of rubberised nylon fabric manufactured by Swastik Rubber Products Ltd., Pune.	1 to 6 cubic m

Table.4 *Approved designs of family type biogas plants*

Size of plant	**Quantity of cattle dung required daily**	**No. of cattle heads required**	**Estimated cost**
1cubic metres	25 kg	2-3	Rs.7,000/-
2 cubic metres	50 kg	4-6	Rs.9,000/-
3 cubic metres	75 kg	7-9	Rs.10,500/-
4 cubic metres	100 kg	10-12	Rs.12,500/-
6 cubic metres	150 kg	14-16	Rs.15,000/-

Table.5 *Size of plants, requirement of cattle dung and estimated cost*

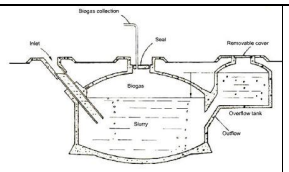

Fig. 4 *Typical layout of bio-gas plant*

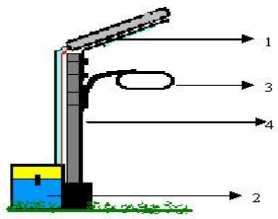

Fig. 5. *Solar street light*

F) Solar energy system :

Solar street light system :

In layout, total road length is 2500 m

Assume, c/c distance between two street lights = 40m

Therefore, No. of street lights required in layout= 63

Assume, Street lights are provided with 250 watt mercury bulbs.

Hence, total electrical energy saved in street lights = 250 X 63 = 15750 watts

Approximate cost for solar street light for 250watt=24,000Rs

Total street light = 63 nos

Total cost=63x24000 = Rs 15,12,000

Depreciation cost 10%= Rs 1,51,200/-

Repair cost 2.5%= Rs 37,800/-

Interest on investment6%= Rs 90,720/-

Total cost= Rs 17, 91,720

By electrical for 0.25kw

12 units per day : cost per unit= Rs 3.5 : per year cost for one street light : (0.25x12x365)x3.5 : = Rs 3832/-

for 63 street light = 63x3832 = Rs 241000,-for per year

Savings

Rs. 17, 91,720 /- to Rs. 241,000 = 7.45years Total cost of street light after 8years save.

VI. COST ANALYSIS

Palse village develop as Green village,

1.Design of water treatment plant=Rs. 86,24,500 /-

2.Design of sewage treatment plant : As per below table Alternative no 2 (UASBR) provided

Methods	Capital cost	Maintenance cost
1.Activated sludge process	97,50,000	18,44,625
2.UASBR	97,50,000	17,22,750
3.Aerated lagoon	82,50,000	24,47,250

Table 6. *Cost comparison of different design methods of sewage treatment plant*

3.Solar street lights=Rs 17,91,720/-

4. Bio-gas Plant (per cu.m) is= Rs 7000/-

Total investment for Green Village 2,18,95,970/- for that various Government Schemes such Adarsh Gaon Yojana, watershed shed development programme, Jal sandharan,NGOs etc

VII. CONCLUSIONS

1. According to the 2001 Indian census, 74% of Indians live in 638,365 villages in different states. Of these, 50% villages have provision for water supply, but very few villages, less than 1% of above have sewage disposal system. Inadequate water supply, no sewage disposal facilities, insufficient health facilities, unemployment and lack of education facilities are some of the major problem in Indian villages. Because of these problem peoples are migrating to city areas which further causes load on public services and increased urbanization.

2. Self sufficient villages as thought by Mahatma Gandhi will improve the village life and reduced the rate of migration to cities. Social reformers, Anna Hazare and Popatrao Pawar have given practical thought to Gandhij's vision. Both have worked for watershed development, deforestation, and overall development of village. Ralegaon sidhhi and Hiware Bazar are the example of ideal village. Cosidering the success stories of Ralegaon sidhhi and Hiware Bazar, Government of Maharastra launched schemes like Adarsh Gaon Yojana, Jal Sandharan, NGOs, Watershed development programe,Gram Swachaata etc.

3. Field visit of Ralegaon Sidhhi and Hiware Bazar, study of Government schemes, the concept of Green village is developed. Green village will give solution to almost all problem related to villages. To develop green village various works such water supply, sewage management, watershed development, sewarge collection and treatment, reuse and recycle of waste etc requires to be implemented.

4. Detailed study of Palse village was conducted for identification of various problems in the village. The studies reveled that inadequate water supply, no sewage treatment and disposal, improper solid waste mangment, need for improving watershed develop ete are the important issues to be solved.

5. Planning and designing of various works are carried out for Palse village to develop the Palse as a green village. Summary of this work is given below.

a) Planning and Design of water treatment plant for next future period. Water supply and treatment works can be provided in two phases, each phase of 2.5mld .Cost of each phase is Rs 73,00,000/-

b) Sewage treatment works can be provide in to phases and each phase of 2mld.three alternative were considered for sewage treatment work. The details of capital investment, operation and maintainance cost is as given below.

1.Design of water treatment plant = Rs 86,24,500/-

2.Design of sewage treatment plant : As per below table Alternative no 2 (UASBR) provided

Serial no.	Capital cost	Maintenance cost
1.Activated sludge process	97,50,000	18,44,625

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REFERENCES

[1] Mohanasundaram, S.: Environment science and engineering. (2008)
[2] Nature, environment and pollution technology, Vol.2.
[3] Zilha parishad, Nashik, Baglan Seva Samiti Report, Satana.
[4] Grampanchayat of Palse, Nasik.
[5] National Bank for Agriculture and Rural Development, (NABARD).
[6] Gandhi, M.K. : Village Swaraj.
[7] Washington, N.W. : Environment and Production Technology Division International Food Policy ResearchInstitute 2033. K . Street, U.S.A. (2006).
[8] John, Kerr, Ganesh Pangare, Vasudha Lokur Pangare, and George, P.J. : An evaluation of dry land watershed development Projects in India.
[9] Indira, Khurana, and Romit, Sen, : Water Aid. Drinking water quality in rural India: Issues and approaches.
[10] Neelakantan, K.S. : Environmental management in urban and rural area. I.F.S. Director, Department Of Environment, Chennai.
[11] Anna, Hazare, : A Veritable Transformation Maharashtra. Ralegan, Siddhi, Pariwar, Prakashan, (1997)
[12] http://indg.gov.in/rural-energy/rural-energy /environment/environment.
[13] http://www.mapsofindia.com
[14] http://picasaweb.google.co.in/someshwk
[15] http://www.censusindia.gov.in/Census_Data_01
[16] http://www.wateraid.org.
[17] [http://www.capcity.adelaide.sa.gov.au/pdf/Girardet%20Initiatives.pdf>.accessed25, September 2008.

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