# An Integrated Planning of Sustainable Residential Towers in Yendada, Visakhapatnam

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***ABSTRACT****-The Prominence given to study, planning and development of a sustainable township for the yen dada in Visakhapatnam. Sustainable township planning makes a hand rise for development of infrastructure. With immense growth of population for employment, educational, health as a result migration is necessary for the people as result of the process. Maximum boost in employment will see in Visakhapatnam zone due to high concentration of industrial activities. In this paper, a broad information of sustainable township is seen with the application of various technologies on residential towers in order to minimize the usage of conventional source and make effective usage of natural resource and to safeguard the environment and for the better health of the occupants of the building & developing of sustainable township in Yendada region is discussed. For such high concentration of employment and population growth they require development of sustainable townships as the income level of the people are grown they are looking for the comforts, pleasant and pollution free atmosphere and it also make the user to make effective usage of natural resources. The study deals with site selection, various technologies that can be implemented on residential towers, advantages, application and benefits through technology is also given. Planning, scheduling and Value addition in various forms in all respects has discussed. Sufficient open spaces and other basic necessities, amenities with better infrastructure facilities has been implemented in the township.*

**KEYWORDS:** *Sustainable township, IGBC, LEED, Roof top Solar generation, Grey water treatment, Rainwater harvesting,*

## I. INTRODUCTION

Cities are the engines for social and economic growth of a country. The urban sector contributes nearly 50-60% to the nation's GDP. Cities are the centre in the creation of employment, Education, Medical Facility and the economic growth in the country.

Creation of job opportunities relates with higher income groups and a standard of living has led to an increase when compared rural population into urban areas. As a result, India has witnessed an unprecedented growth in the urban population. As per 2001 census, 28% of India's total population resides in urban areas. It is estimated that by the year 2030, the urban population would rise to 42% of the total population of the country**.**

Rapid growth in urbanisation has placed massive strainon land and other natural resources. The shortage of housing has led to creation of slums &unauthorised settlements. Authorities to look for providing amenities to the settlements and Rising pollution levels, traffic congestions and inadequate waste management have resulted in a deteriorated quality of life and environment in the urban areas.A township is a place where people get enormous benefits in communities; a community in turn is a combination of several sectors. Several townships form a city. Township ranges in sizes and land uses. Townships are typically mixed-use in character.

Township comprises of a residential component. 25% of the total built-up area (in sq. m.) within the township should be allotted for residential use, for it to qualify for certification.

A sector should consist of a mix of land uses ranging from commercial to residential. Sectors promote walking through a complementary relationship between transportation, land use and urban design character of the place.

The Indian Green Building Council (IGBC) & Leadership in Engineering & Environmental Design (LEED) are the Rating systems that are used to give rating and is a State government organisation encouraging to develop townships where the security, road maintenance and administration of the sustainable township are managed by the developers, sustainable township to address the issues of sprawl, automobile dependency, social and environmental issues. Developments are evaluated on the following broad aspects:

- Environmental planning
- Land Use planning

- Resources management
- Community development

**Benefits of Green / Sustainable Township**

IGBC & LEED are the authorised to give rating to sustainable township with large developments having various benefits, such as efficient land use, habitat preservation and restoration, effective transport management, efficient use of resource and enhanced quality of life for the occupants.

❖ **Efficient Land Use:**

Development has become synonymous with physical expansion or growth. There is a need for significant changes in the pattern of land use and construction that will provide communities with better quality of life and at the same time conserve natural resources.

❖ **Habitat Preservation &Restoration:**

Conventional development is generally insensitive to natural environment. Such developments may scarthelandscape.

❖ **Efficient Transportation Management:**

Traffic congestion, long distance commuting, rising levels of air and noise pollution are pressing issues in today's cities. Efforts to relieve congestion such as, constructing flyovers, road widening etc., are good initiatives but may not address issues such as fossil fuel consumption and associated emissions.

❖ **Efficient Use of Resources:**

Perhaps the most challenging problem facing our cities today is to meet the ever- rising demand for power, water supply and waste management. Meeting this demand requires enormous amount of investments infrastructure. Efficient and effective use of resources is thus vital in augmenting the existing infrastructure.

- **Water Efficiency:** Most of the Asian countries are water stressed and in countries like India, the water table has reduced drastically over the last decade. Green townships encourage use of water in a self - sustainable manner through reducing, recycling and reusing strategies and can savepotablewatertoanextentof30-50%.

- **Energy Efficiency:** Energy consumption of infrastructural equipment through energy efficient street lighting, motors, pumps etc. By implementing this we can save up to 20 - 30%. on-site power generation using various renewable energy technologies and other clean fuels can significantly reduce the load on grid power supply.

- **Waste Management:** Sustainable township follow various strategies segregating of waste at source and promoting the reuse / co-processing of products.

❖ **Enhanced Quality of Life:**

The place that we live in has profound effect on our lives. People have a natural predisposition to feel better and perform better in liveable &safe environments. creation of diverse, connected, affordable, safe and healthy communities that enhance social interaction and ownership.

sustainable townships meet land use and compact planning are the characteristic of a green development, which encourages the usage of battery vehicle with in the township and leads to gradual decrease of greenhouse emissions. The outdoor air quality is enhanced by providing landscaped areas, encouraging the use of clean fuels for vehicles. Noise levels are reducedby provision of vegetative buffer. Green buildings and energy efficient infrastructure further aid in reducing the greenhouse gas emissions. public spaces encourage physical activity and help in improving public health.

## II. LITERATURE REVIEW

Self-Sustainable Township Planning by Padhye P. R, Urade S. P, Deo N. N provided an important paper concepts of town planning, principles of town planning. The concept of townplanningdealswithtownshipplanningdemandsactiveimaginationandsharpcommon sense of the understanding of the various needs of the society occupying or likely to occupy the township. The concept of principle town planning deals with Green Belts, Housing, recreational centre's and other required social amenities for the dwellers.

Before planning and site selection for townships, the amenities to be generally provided to the sustainable township has been studied. The study on Various technologies which can be applicable and most suitable are studied and the generation, savings usage and benefits are taken in to consideration while studying about the various renewable technologies and methodologies.

## III. METHODOLOGY

### *3.1 Selection of site for construction of sustainable township.*

"Walk to Work" is mantra of the township planning. The Site is selected at Yendada area, 20 Acre. in Visakhapatnam.

*Road Connectivity*: National Highway connected in just 5 min drive and Beach road is connected in 2 min

drive from the site.
*Air connectivity:* Visakhapatnam Airport-40kms which is 30 min drive
*Rail connectivity:* Nearest Railway station-Vizag- 10 Kms which is 20 min
reason to choose Yendada site is that it is located in IT hills where the high income earning people will look for high comforts and quality life.

### *3.2 Various Technologies used on Residential Building of Sustainable Township*

#### *3.2.1 Roof Top Solar*

A Rooftop photovoltaic power station, or rooftop PV system, is a photovoltaic system that has its electricity generating solar panels mounted on the rooftop of a residential or commercial building or structure. The various components of such a system include photovoltaic modules, mounting systems, cables, solar inverters and other electrical accessories**.**

***ADVANTAGES***

- Utilization of vacant rooftop for power generation.
- Can generate power for self consumption and feed excess power to the Grid.
- Provision for settlement of registered surplus energy fed to the grid on a half yearly basis.
- Surplus energy injected shall be considered for payment by the DISCOM at pooled cost decided by the APERC.
- Generation of environmental friendly green energy.
- Reduction in diesel consumption where DG back-up is provided.
- Capital subsidies from Govt. of India and Govt. of A.P.

***REQUIREMENTS***

- A minimum vacant roof area of 10 Sq. mtr or 100 Sq. ft is required for installation of 1 Kwp system
- The consumer shall have 3 phase supply service connection.
- Mandatory safety precautions / features shall be installed as per the norms
- A single bi-directional meters shall be installed for export and import
- The standard equipment as per the norms of MNRE/APTRANSCO/DISCOM shall only be installed
- The vendor executing the turn key solution should be a channel partner of MNRE or manufacture / supplier / system integrator approved by NREDCAP.

| CONTEXT | ATTRIBUTE | TOTAL |
|---|---|---|
| Total units produced(min.) | 10 months | 60000 units |
| Total units consumed | 12 months | (-)54000 units |
| Excess units | 60000-54000 | (=) 6000 units |
| Income Generated* | 6000 x 5.48 | Rs. 32,880/- |
| Total Expenditure | 12 months | Rs. 3,94,560/- |
| Total savings | Rs.3,94,560+ Rs. 32,880 | Rs.4,27,440/- |

***INCENTIVES***

- Central Financial Assistance upto 30% of the system cost may be provided by MNRE as per the prescribed eligibility criteria.
- The State Govt. will provide 20% subsidy for installation of roof top system upto 3 KW capacity in domestic sector only. This will be in addition to that eligible Central Financial Assistance.
- The payment of pooled cost will be made effective for a period of 7 years from the date of establishment of such SPV plant.
- The settlement of registered surplus energy will be carried out on a half yearly basis.Surplus energy injected by Solar Roof Top/Small Solar PV generator shall be considered for payment by concerned APDISCOMs at pooled cost as may be decided by APERC for that year.

**Generation of Solar energy on Residential Buildings as follows:**

- 2 BHK DIMENSIONS: 26 m * 42 m = 1092 $m^2$

- 1 kw space requirement: 10 $m^2$ or 100 sq. ft

Table 1 Capacity of Solar Installed on 2 BHK Tower

| CONTEXT | CALCULATION | TOTAL |
|---|---|---|
| Plant capacity | | 50 KW |
| Area required | 50KW x 100(Sq. ft) | 5000 Sq. ft |
| Monthly Production (30days) | 50KW x 120(units) | 6000 units |
| Yearly Production (for 10 months) * | 6000 x 10(months) | 60000 units |

8 BLOCKS = 1600 units / day;
= 4,80,000 units / annually (300 Sunny days a year)

***Profits Estimation:***

Table 2: Profit Estimation from Solar Installed on 2 BHK Tower

3 BHK DIMENSIONS: 30 m * 45 m = 1350 $m^2$
1 kw space requirement: 10 $m^2$ or 100 sq ft

1350 m can accommodate = 1350/10 =135 kw (Full Capacity of Roof Top)

Roof Top Solar Panel Proposed in township = 60kw

| CONTEXT | CALCULATION | TOTAL |
|---|---|---|
| Plant capacity | | 60 KW |
| Area required | 60 KW x100(Sq. ft) | 6000 Sq. ft |
| Monthly Production (30days) | 60KW x 120(units) | 7200 units |
| Yearly Production (for 10 months) * | 7200 x 10(months) | 72000 units |

- 1 kw on average generates 4 units a day
- 60 kw generates 240 units a day
- 6 BLOCKS = 1440 units / day
- 4,32,000 units annually (300 sunny days per year)

Table 4. Profit Estimation from Solar Installed on 3 BHK Tower

| CONTEXT | ATTRIBUTE | TOTAL |
|---|---|---|
| Total units produced(min.) | 10 months | 72000 units |
| Total units consumed | 12 months | (-)54000 units |
| Excess units | 72000-54000 | (=) 18000 units |
| Income Generated* | 18000 x 5.48 | Rs. 98,640/- |
| Total Expenditure | 12 months | Rs. 3,94,560/- |
| Total savings / year | Rs.3,94,560+ Rs. 98,640 | Rs.4,93,200/- |

### *3.2.2 ROOFTOP RAINWATER HARVESTING*

Rooftop Rain Water Harvesting is the technique through which rain water is captured from the roof catchments and stored in underground sumps.
Harvested rain water can be stored in sub-surface ground water reservoir by adopting artificial recharge techniques to meet the household needs through storage in tanks.

***ADVANTAGES:***

- By storing of water in the sump & reutilizing, around 35% of the annual requirement of a household can be met. Thereby a considerable amount on the water and power bill can be saved.
- Dependency on water tankers, ground water and corporation water can also be much reduced.
- Recharge of Groundwater, replenishes the deeper layers of the earth's crust which in turn insulates the earth from rise in temperature, reducing global warming.
- Reduces loss of top soil, surface runoff, thereby avoids silting of ponds and lakes.
- Reduces hardness, salinity and TDS contents in the bore well.
- Seawater ingression can be checked in costal line.

- All materials used in this Technology are eco-friendly and recyclable.
- Checks overexploitation of groundwater source.

**OBJECTIVES:**

- To protect the planet's most precious resources by implementing both rooftop as well as Groundwater
- To collect every drop of Rain without the help of external source of energy (electricity / fossil fuels) since the
- filters are designed to operate by gravitational force.
- Minimize the carbon foot print by using recyclable and bio degradable materials to protect the ozone layer.
- To provide water security to the Nation.
- To provide safe, clean, pollution free drinking water to all citizens.
- Assured supply of water for irrigation and potable water, in rural and urban areas, especially in periods of drought.
- To improve the quality and quantity of Groundwater source.
- To reduce the dependency on corporation, municipality, Ground water and Tankers water supply.

**FORMULA:**

- Total quantity of water to be collected(cum)=Roof Top Area(Sq.m)x Average Monsoon Rainfall(m)x 0.8
- Water that can be saved through Rain water harvesting on Residential building is as follows:
- The rainfall for Visakhapatnam district = 1016mm
- On an average rainfall taken for yendada region = 800 mm
- 2 BHK dimension = 26 m x 42 m = 1092 Sq.m

  = 11754 Sq.ft
- 5000 sft capacity of 3 is attached to each block
- Water harvested through one 2 BHK block = 11754 * 210/10.76= 2,29,340 liters
- The total 2 BHK Blocks That harvest the water in township = 2,29,340 * 8 = 18,35,197 liters / annually

  3 BHK dimension = 30 m x 45m = 1350 m2 =14531 Sq.ft
- 5000 sft capacity of 3 is attached to each block
- Water harvested through one 3 BHK block = 14531 * 210/10.76=2,83,598 liters
- The total 3 BHK Blocks That harvest the water in township = 2,83,598 * 6= 17,01,585 litres / annually

Under Ground sump capacity of 2 lakh litres is having for water storing and use for the daily purpose of the people in township, where there is no water need to be sent from the source point as a result so much amount of water and electricity for conveyance can be minimized by adopting even for monsoon season.

***3.2.3 GREY WATER***

- Greywater can be defined as any domestic wastewater produced, excluding sewage.

***ADVANTAGES:***

- Reduces fresh water requirement
- Prevents greywater stagnation
- Prevents vector breeding
- Use in flushing toilets to make toilets functional
- Use of greywater in gardening

**GREYWATER RECYCLE & REUSE IN TOWNSHIP**

- Township Complex with 1100 Residential Units. (2 BHK & 3 BHK)
- Average consumption of Freshwater is @ 135 liters/day/person
- Each unit has say 4 persons for 2 BHK
- Hence Total Freshwater required shall be 135 x 4 x 704=380160 litres/day.
- The amount of GREY WATER treated in the TOWNSHIP= 704 x 4 x 75=2,11,200 litres/day
- Each unit has say 4.5 persons for 3 BHK
- Hence Total Freshwater required shall be 135 x 4.5 x 396=240570 liters/day
- Total fresh water for residential blocks = 677160 litres.
- The amount of GREY WATER treated in the TOWNSHIP

  =396 x 4.5 x 75

  =1,32,795 litres / day

Total extent of land 20 ACRES at yendada, the builtup

area of buildings in Township is tabulated as follows:

Table 4. Built up area of Township and Layout of the township.

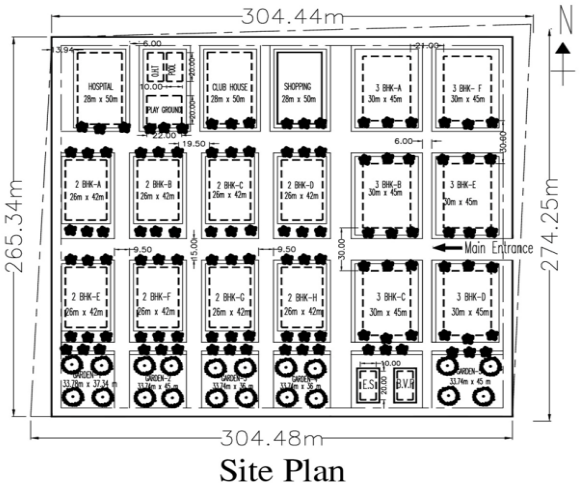


Figure 1 Auto cad Layout of Sustainable Township

| S.no | Buildings | Area (Acres) | Built Up area (%) |
|---|---|---|---|
| 1. | Double Bed Room 940 sq. ft. eight blocks | 2.154 | 10.77 |
| 2. | Triple Bed room 1540 sq. ft. six blocks | 2.154 | 10.77 |
| 3. | Function Hall & Club House | 0.3459475 | 1.725 |
| 4. | Shopping Complex, office space, recreational | 0.3459475 | 1.725 |
| 5. | Mini Hospital | 0.3459475 | 1.725 |
| 6. | Swimming Pool | 0.04 | 0.2 |
| 7. | Mini Play ground | 0.10 | 0.5 |
| 8. | Road network (Round network) | 7.08 | 35.4 |
| 9. | Vacant land, gardens and other amenities | Remaining land | |

Figure 2 Site View with elevation done using Revit Software

Table 6. Number of dwelling units present in township.

| S.no | Building | Number of Floors | Total Block | Total no of flats in a Block | Total Units in all Blocks |
|---|---|---|---|---|---|
| 1. | 2BHK 940 sq. ft. flat | G+10 | 8 | 88 | 704 |
| 2. | 3BHK1540 sq. ft. flat | G+10 | 6 | 66 | 396 |

Township consists of Eight blocks of Double bed room flats; these blocks are 940 sq. ft. flat area. Itconsistsofsix blocks of triple bed room flats of 1540 sq. ft. plinth area. with G+10 floors each.Hence, the total number of residential units in my township are 1100

Table 7. Approximate time estimates of various projects in township.

| S.no | Project | Cost (Rs.) |
|---|---|---|
| 1. | Double Bed Room Flat 940 sq. ft. Block | 17,15,51,212.0 |
| 2. | Triple Bed Room Flat 1540 sq. ft. Block | 19,09,37,000.0 |
| 3. | Club House & Function Hall | 3,78,30,374 |
| 4. | Shopping, office, Recreational | 4,05,35,374 |
| 5. | Mini Hospital | 2,98,92,000 |
| 6. | Roads & Drainages | 12,00,00,000 |
| 7. | Battery Vehicle Parking | 2,00,00,000 |
| 8. | Overhead tank | 35,00,000 |
| 9. | Playground | 20,00,000 |
| 10. | Swimming Pool | 5,00,000 |

Total estimated time period for completion of the project is 1008 days. All the projects mentionedintheabovetablestartsonsamedayandfinishe sonbynumberofdaystakenby each individual project. Time estimates are drafted by approaching some expertise in local andassumptionismadethatnonaturalcalamitiesoranyde ficiencyofmaterialorequipment had taken place during construction of the project. If this assumption is not made the durations may varying depending on local conditions, supply of material, labor and equipment.

Table 8. Approximate cost estimates of various projects in township

| S.no | Project name | Time period |
|---|---|---|
| 1. | Double Bed room 940 sq. ft. | 1002days |
| 2. | Triple Bed room 1540 sq. ft. | 1007days |
| 3. | Club House & Function Hall | 203 days |
| 4. | Mini Hospital | 256days |
| 5. | Compound Wall | 182 days |
| 6. | Play ground | 119 days |
| 7. | Roads and Units | 176 days |
| 8. | Swimming pool | 28 days |
| 9. | Water Tank | 186 days |

TownshipestimatesaredraftedbyAndhraPradeshsched uleofrates2016-17guidelinesand rate for materials, labour rate etc. Based on the Andhra Pradesh schedule of rate the estimates aredrafted.Abovetablerepresentsthetotalestimatedcost forconstructionofdwellingunits.

### 3.1 Market sale cost of dwelling units after value addition method in township.

The value addition means growth its cost by adopting several alternate means. In this category of value addition, we are allocating about the township. If the site is taking some value of cost but, by building the townships its value upsurges to more than 5 times of inventive cost.

**Table 9. Total addition values of Residential Towers**

| S.no | Projects | Total construction cost (Rs.) | Total Sale cost (Rs.) |
|---|---|---|---|
| 1. | 2 BHK 940 sq. ft. block | **17,15,51,212.0** | 2,643,956,480 |
| 2. | 3 BHK 1710 sq. ft. block | **19,09,37,000.0** | 2,137,045,680 |
| | | | 4,781,002,160 |

Table 10 Table Showing the cost of Land and Construction cost of Residential Tower

| S.no | Item | Cost (Rs.) |
|---|---|---|
| 1. | Site Cost | 1,936,000,000 |
| 2. | Construction Cost | 2,131,312,496 |

Total cost (Site + construction) = Rs. 4,067,312,496 (406 crores)

Market Sale Value is Rs. 4,781,002,160 (478crores)

Profit Value is Rs. 713,689,664 (71.3 crores) which is 1.3 timesgreater.

Construction cost of other amenities provided in township i.e., club house, Health centre, Roads,

Compound Wall, Overhead Tank etc. is Rs.38,00,00,000 (38 crores)

These 38 crores have to be taken from the profit, these amenities are provided to fulfill the requirements and to attract the dwellers

## IV. CONCLUSIONS

1. By construction of this township 1100 families will be benefited.
2. Various Technologies were implemented with known advantages with savings in water power and usage of naturally available materials
3. The carbon emissions can be minimized by making usage of natural resources.
4. By constructing projects like township 460 laborers and employees are benefited.
5. By constructing projects like township 30 employees are used for maintenance in townships.
6. The dream of own house in smart city for the people will be full filled. Smart Transport is also done with in township by making usage of battery vehicles and road connectivity is done in a better way.
7. By constructing projects like township in our smart city we rise our hand in developing the infrastructure in smart city.

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