

Brief:
 145 Ha.
 Approximately 12 km away from Railway Station
 Surrounded by Hazira industrial area
 Approximately 2 to 5 km away from Arabian Sea
 Propose land use: Residential
 Conditions: affordable housing program for labour and farmers
 Operational tool: Town planning scheme

This site is suitable for living/housing?

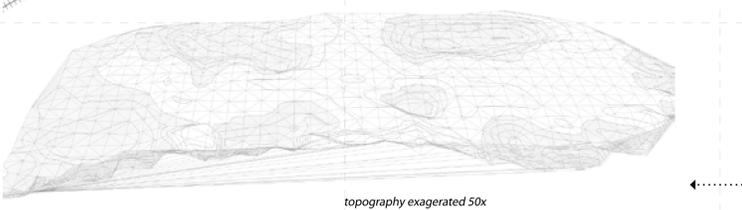
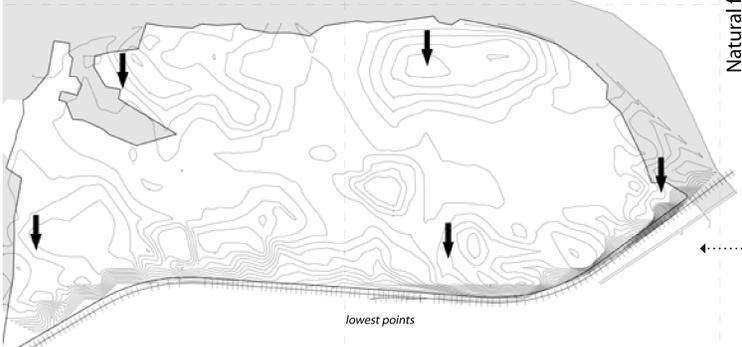
Stakeholders involved /



A/

Analysis matrix
SITE LEVEL - POSSIBILITIES

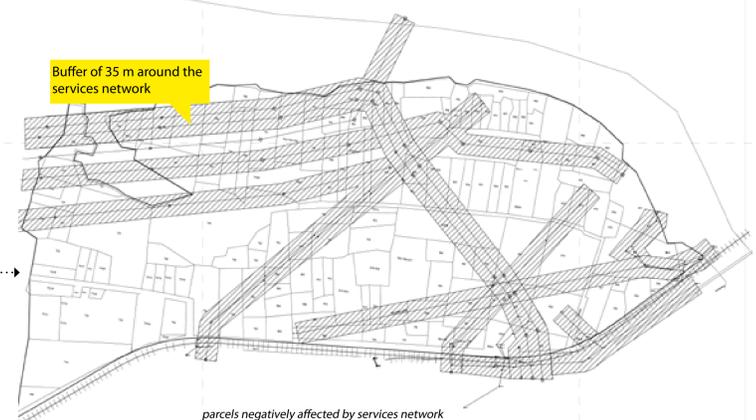
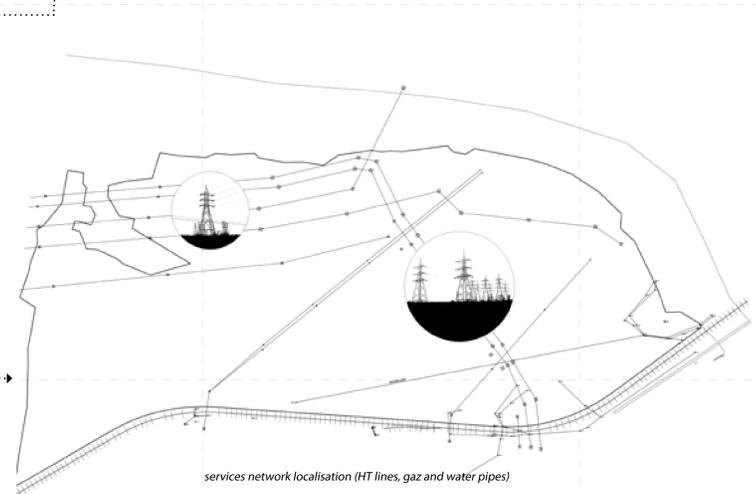
Topography and high flood risk areas /



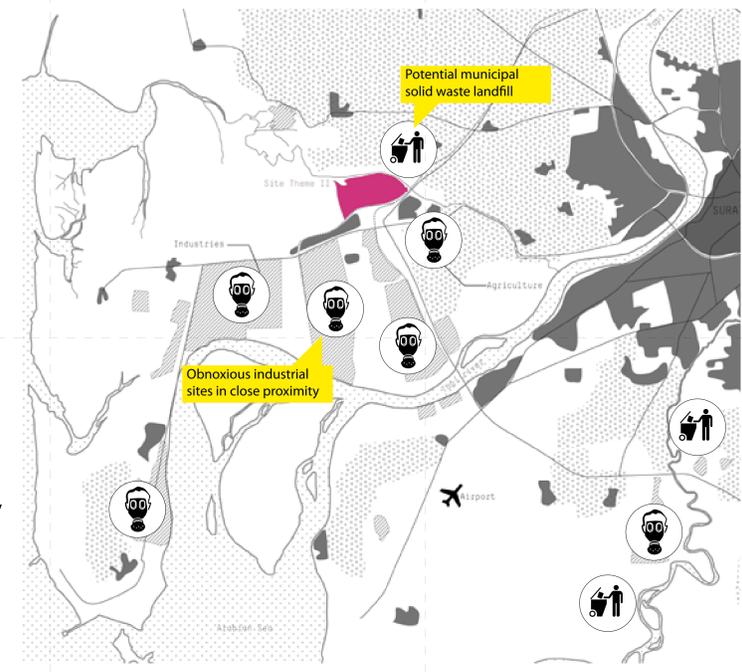
Natural factors

Anthropic factors

Services network (HT lines, gaz & pressurized water pipes) /



Site context and connectivity /



The site is situated at 5 km from Surat city center, and potentially connected by rail and by water (Khadi channel).

Industrial activities surrounding the site are a limiting factor in its development because of the risk of population exposure to industrial pollution.

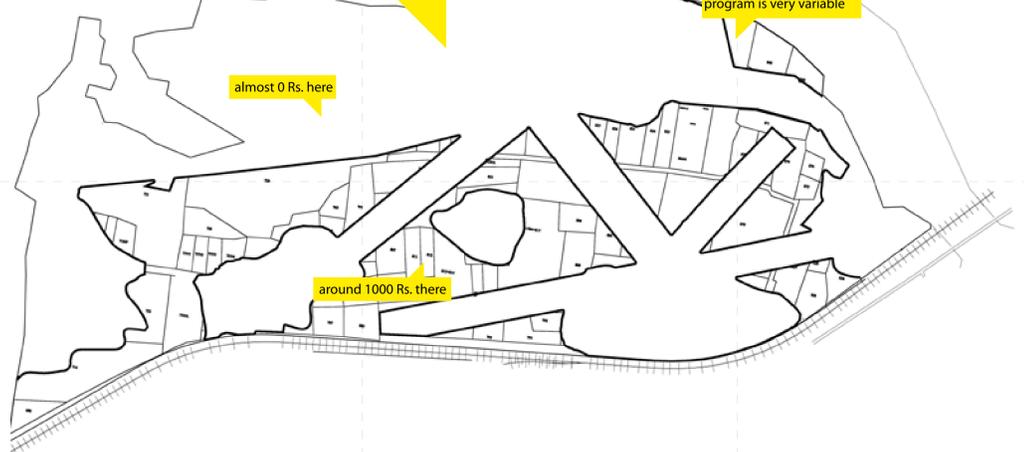
A municipal landfill is located opposite the site, on the other side of Khadi channel.

Operational and strategic conclusions

To integrate the numerous owners in the proposed development is not a major constraint, since historically, the state managed to develop participatory tools (Town planning scheme for example).

The main concern is to know if it is really strategic for the city to develop a new township so disconnected from the existing urban tissue, in a risky industrial environment.

site analysis result : the residue land usable for housing program is very fragmented and isolated.



32% of parcels are potentially affected by the regular flood events.

- Some technical solutions can be implemented in attempt to minimize the impact of flooding on homes:
- move the earth to artificially increase the level of the site
 - construction on stilts;
 - increase the flooding area on certain part of the site to preserve some other thanks to an integrated landscaping approach;

... but two questions remain :

- 1- Is it really possible to use these expensive processes while keeping the idea of producing affordable housing for the poorest populations? **Maybe, but only with an intensive research process.**
- 2- On a larger scale, do we not risk the increased (flood) pressure on the surrounding land? **Definitely. And this is not acceptable in a global and strategic approach.**

From now on, everyone agrees to think that it is prudent to respect a buffer of at least 35m either side of High tension lines and other networks to avoid exposing people to health risks.

in this scenario, **41%** of parcels are partially affected by the buffer zone along services network.

- 1- Then, is it possible to move out of the site these High Tension lines gaz and pressurized water pipes? **Yes it is technically possible but, once again, out of scale financially and strategically.**
- 2- Is it possible to consider other less risky usages to use the affected areas? **Yes it is feasible to use these spaces for activities which exposed human to magnetic field in a short time span. Thus we can imagine to use them for industrial activities, agricultural production, power generation ...**

Risk based approach conclusions

In the present situation, it seems too dangerous to develop a residential project on this site. Measures to mitigate the risk factors seem to be not economically affordable according to the scale of the project.

Analysis matrix
PUBLIC (AUTHORITIES) RESPONSABILITIES

Risk management / safety

-The management of a city especially in catastrophic situations requires an integrated approach which covers and protects all sections and parts of the city.

-An example of this was the 2006 floods that saw the industries of Surat, otherwise perceived to be outside the city administration periphery, look to the authorities for the mismanagement of the Ukai Dam.

-They, like the rest of the city, hope to be secure from future calamities by fixing the responsibility on the concerned authorities not just for knee jerk reactions of safety but a comprehensive plan for the future.

-This proves that an integrated approach and a better understanding of all urban, ecological, infrastructural, social and economic parameters is necessary to develop a complete risk management system that secures the city and the systems feeding into and from it.

Anticipation / long term vision - strategy

-Risk Management is never divorced from the idea of a longer term vision. In the case of Surat with its impending dangers of flood, health risks and rising sea levels; a clear long term vision and its comprehensive viability has never been more urgent.

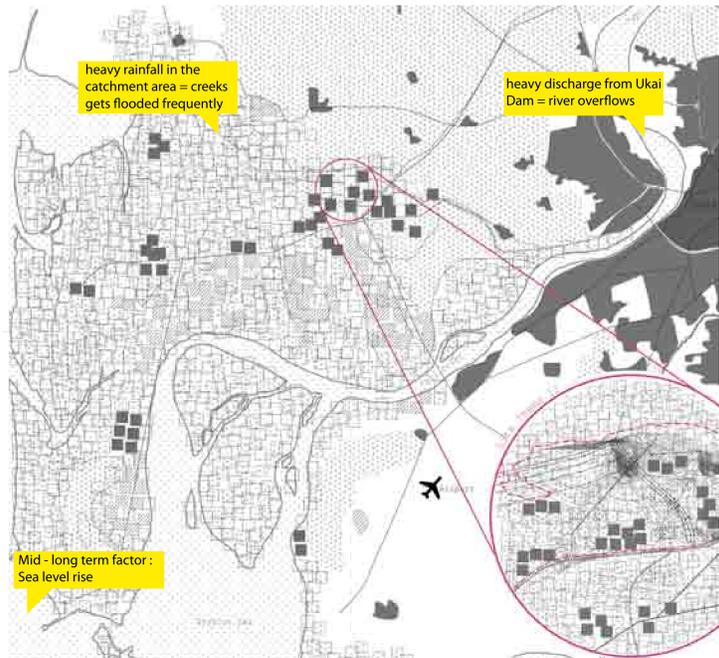
-These reflections have made us reconsider the given site context as purely a residential one. On the flipside the site holds immense potential in being one part of a larger network that works for the city.

-With this it is however important to understand the site and its surroundings can be potentially flooded in the future

-Hence any investment needs to be optimised across timelines of short and long, with high value of return for the owners and city alike.

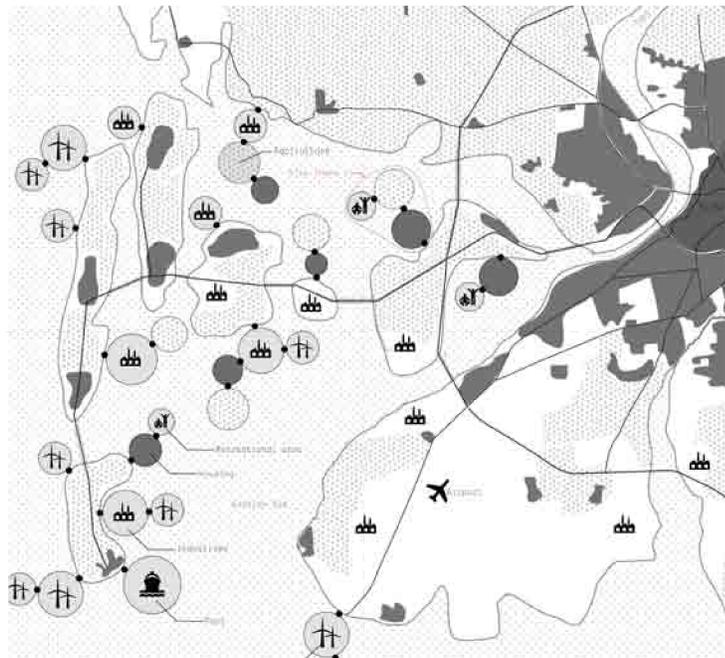
Surat 2020: «City in the wetlands - city in an estuary» /

Surat 2050 : possible scenario «Polder city» /



One part of the long term vision to secure the city is to "open" more land for flooding. In our site context we see the land being available and adaptable to flood situations by nature and by design. Efforts of walling the city against its water, both river or sea may prove to be more detrimental than helpful.

The strategy of opening up more land for flooding also pushes us to reimagine land use in short and long periods. It has the added potential of addressing the issue of diversification of land and economic activities in different parts of the city differently; through added social and economic values.



It may help to imagine a situation of the distant future to make some decisions today. This is one such attempt; to imagine Surat 2050.

If we only consider the rising sea level as per the scientific simulations, we envision a «Polder City scenario» with the mainland of Surat being its own port.

This picture is an indication for us to evaluate current or future planning decisions and its impact on the blurring urban flood ecology of the city of Surat.

C/
Projection matrix
REGIONAL / METROPOLITAN LEVEL

Urban growth / management Infrastructure optimization Socio economic conditions

-Surat is among the fastest growing cities in India with 4% pa migrant influx. With this the peripheral situation (esp. services) will get more complex.

-Most industrial areas (employment generators) are currently in the vicinity of the villages, which are in danger of being encroached upon by the sprawling city.

-Strengthen the connectivity between the center and the periphery (work-live). Improve and invest within the city and in the surrounding villages to absorb this growth sustainably.

-Providing new infrastructure, unless absolutely essential and for a larger good of the city, is not only an expensive affair but also leads to sprawl and consequent mismanagement.

-There are many proposals made in the transportation area within the city, like the BRT and the MRTS, showing the need for mass transit.

-There is also huge amount spent on roadways and flyovers within the city, which need to be evaluated now for their impact on the city fabric and future sustainability.

-The peripheries, eg. our site, though it has a rail line, there is no mass transit rail connection for the employees of the industrial sector. Even by industry standards it is underused.

-The Tapi river, due to its flooding, heavy silting is rather underused as an important infrastructure layer of the city, which it should be used for transportation or risk communication during flooding.

-The condition of work-live is an important one in Surat with more than 50% of the population employed in the manufacturing sector.

-There is a high percentage of almost 20% of the city's population living in slums, owing to large scale migration.

-There needs to be quicker and better mass transit solutions that connects the city to its 'workshops'.

-It is important for migrant labourers from rural Gujarat and other states to be accommodated into the city. This will enable the provision of public utilities and services, which is not possible on the periphery and may later lead to a logistical problem. However they need to be well connected to their regions of work, especially the industrial sector.

Metropolitan potentials /



Economic activities

-Surat has a traditionally high concentration of textile and diamond industries, petro chemical, power, all of which are land and labour intensive.

-The global economic slowdown and changing trends in diamond mining in Africa, resulted in large scale unemployment in the diamond sector. This hints at the need to invest in areas which are sustainable for the region and the people.

-Heavy Industries have led to environmental degradation of the area. New economic activities should take care not to worsen the situation.

The trend in agro, clean energy investments will help in the remediation and more importantly add to the diversity of the economic activities, land use and employment opportunities in the city.

Energy sector

-Surat currently has a host of large non renewable power projects, with the latest entrant being a Lignite plant and future investments in natural gas.

-With increase in oil prices, exhaustion of natural resources and the ever increasing power demand in the city and state, the need will be to diversify the power portfolio to renewable clean energy.

-Wind is already a tapped sector in Gujarat. Solar farms pose a huge possibility in Surat as energy and as a tool to add value to otherwise unusable land.

-Energy produced from Solid waste can be another possibility, using the existing infrastructures.

-Agriculture for the purpose of producing energy crops, like Algae can be explored.

Waste management

-The city is facing larger amounts of waste to deal with due its rapid urbanization. Problem of mixing of storm water with sewage and solid waste which is one of the reasons for the river overflow.

-Most of the landfill sites in Surat have reached their full potential, and the sewerage plants are undercapacity. The sites are located on the banks of a water body on most occasions. These scenarios however pose certain opportunities for the city.

-harness the increased solid waste for biomass,

-introduce algaculture near sewerage/gas plants for waste treatment. The Algae after digesting the CO2 is turned into potential biomass,

-The waste can be transported along the water ways to reach a MSW plant in a flexible time periods.



TOOLS TO ADAPT...

The previous multi-criteria analysis demonstrates that it is neither physically feasible nor strategically desirable to develop a new residential township on the proposed site.

Nevertheless, the need to create affordable housing for the poorest populations is not questioned by our approach. Our analysis of the Surat's situation persuades us, that it seems preferable to integrate these operations into a global process of urban renewal of the existing fabric.

Rather than encourage urban sprawl and social isolation of the most vulnerable, we are convinced that the role of planners and local authorities is to work for a better social and physical integration of all populations.

Moreover, in a context of scarcity of financial resources, it seems crucial now to initiate a reflection based on a «cost-effective risk based» way of thinking. In a middle / long term perspective, the west part of Surat is the most vulnerable part of the metropolis. Present activities in this part will probably mutate either because of the natural economic evolution (the energy industry is likely to be heavily bound to evolve) or because of the inability of the companies to shoulder the potential cost of natural and environmental risks.

In this perspective, the site can be a wonderful catalyst for changes to be made. We can initiate a process of "strategic uses" of the site, which would take into account:

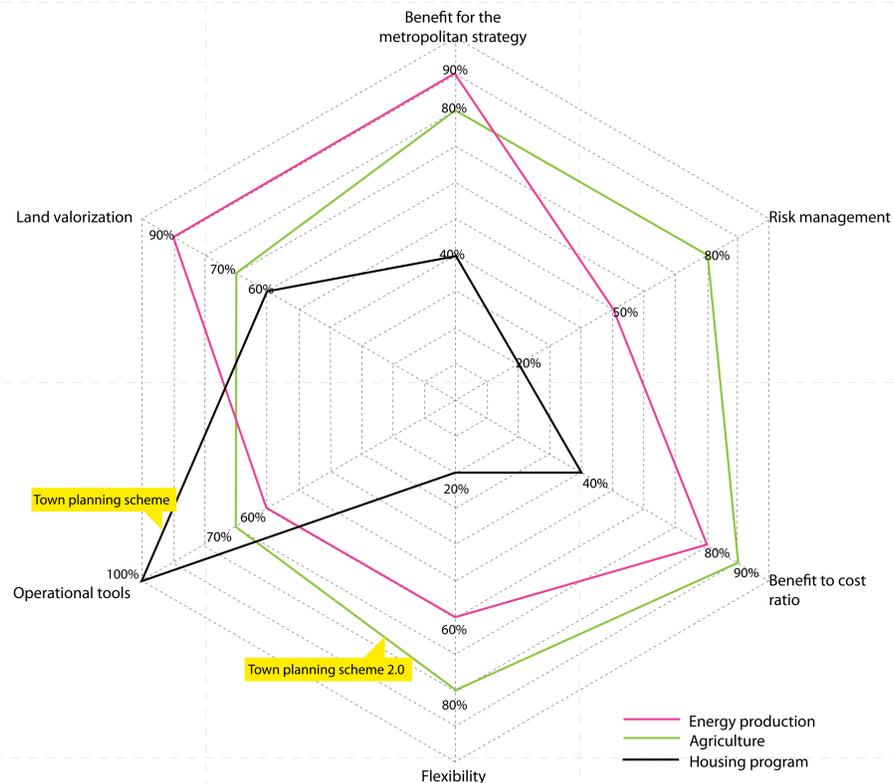
-The consideration of the long term and associated uncertainties (climate changes in particular), through the implementation of a flexible and scalable scenario ;

-To use the site as a «servant space» and make it a viable participant in the development of the city by hosting crucial functions could ensure food self-sufficiency in the region, or perhaps participate in the diversification and energy security. Leading international trends seem to prove the development of the metropolis is directly linked to the development of the "servant space".

-The interests of landowners to valorize their land, through the creation of innovative, flexible and cost effective management tools.

Finally, because we believe that issues of territorial development cannot be solved merely in the development of infrastructure and buildable areas, we believe it is possible to improve the existing tools of urban management by integrating the contributions of related disciplines.

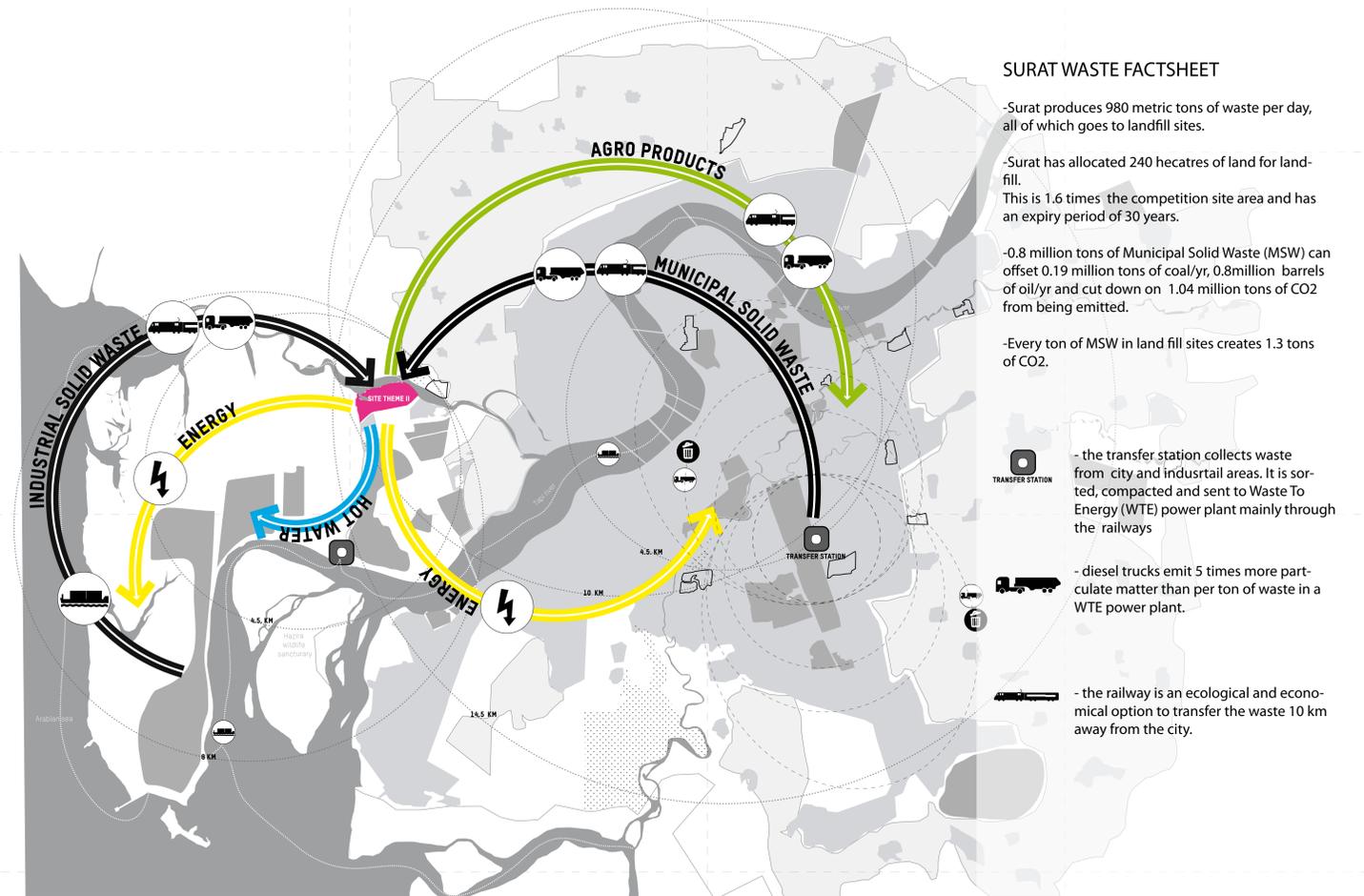
The «Town Planning Scheme 2.0» must take into account all these new challenges. The two scenarios that we propose for the site may be the beginnings.



Activity based efficiency assessment /

Area required (Ha./ MW)	Investment cost (Cr. / MW)	Technologies
5 Ha./MW	25 CR	SOLAR FARM
6 Ha./MW	15 CR	WASTE TO ENERGY
77 Ha./MW	5 CR	WIND
0.8 Ha./MW	5 CR	FOSSIL FUEL ENERGY
3,500Kg./Ha.	0.01 CR	AGRICULTURE

Comparative energy - land consumption matrix /



Site as catalyst for city - potentials /

SURAT WASTE FACTSHEET

-Surat produces 980 metric tons of waste per day, all of which goes to landfill sites.

-Surat has allocated 240 hectares of land for landfill. This is 1.6 times the competition site area and has an expiry period of 30 years.

-0.8 million tons of Municipal Solid Waste (MSW) can offset 0.19 million tons of coal/yr, 0.8million barrels of oil/yr and cut down on 1.04 million tons of CO2 from being emitted.

-Every ton of MSW in land fill sites creates 1.3 tons of CO2.

- the transfer station collects waste from city and industrial areas. It is sorted, compacted and sent to Waste To Energy (WTE) power plant mainly through the railways

- diesel trucks emit 5 times more particulate matter than per ton of waste in a WTE power plant.

- the railway is an ecological and economical option to transfer the waste 10 km away from the city.

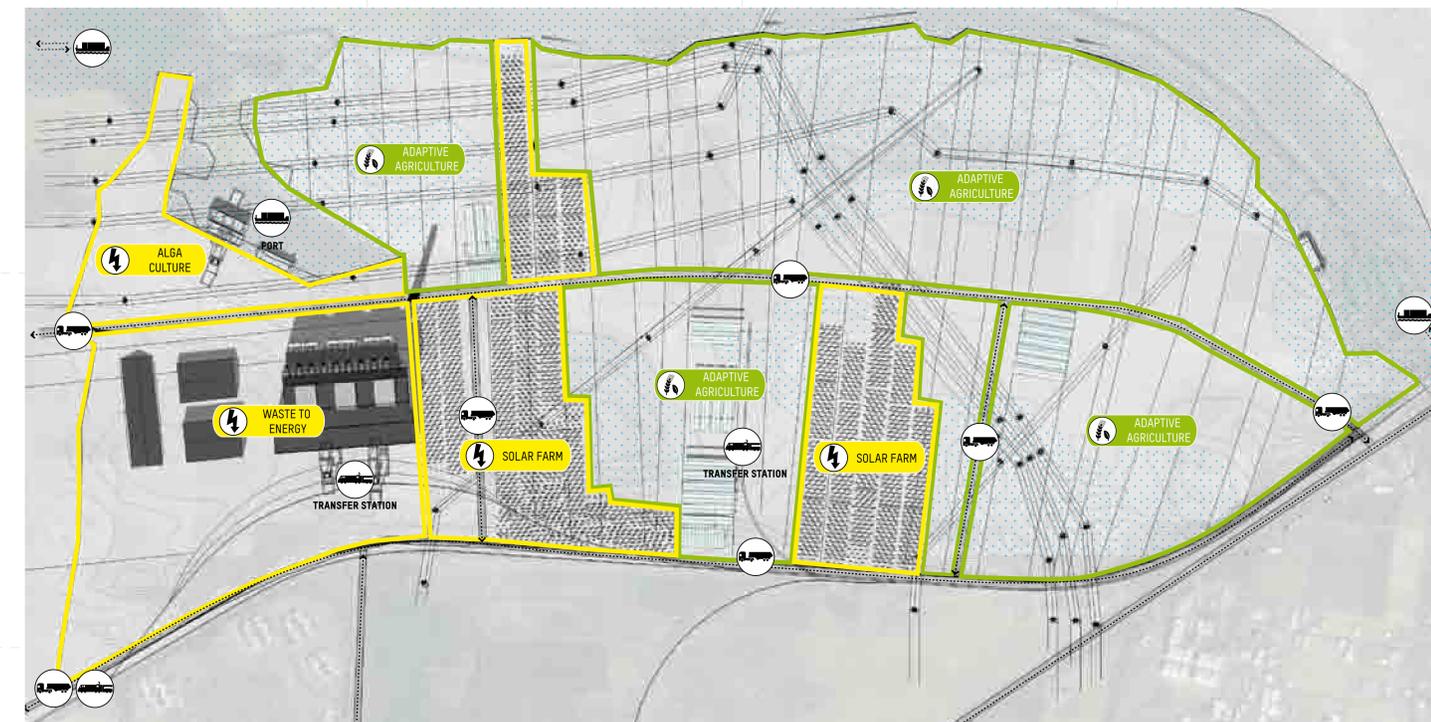


Diagram of functions /

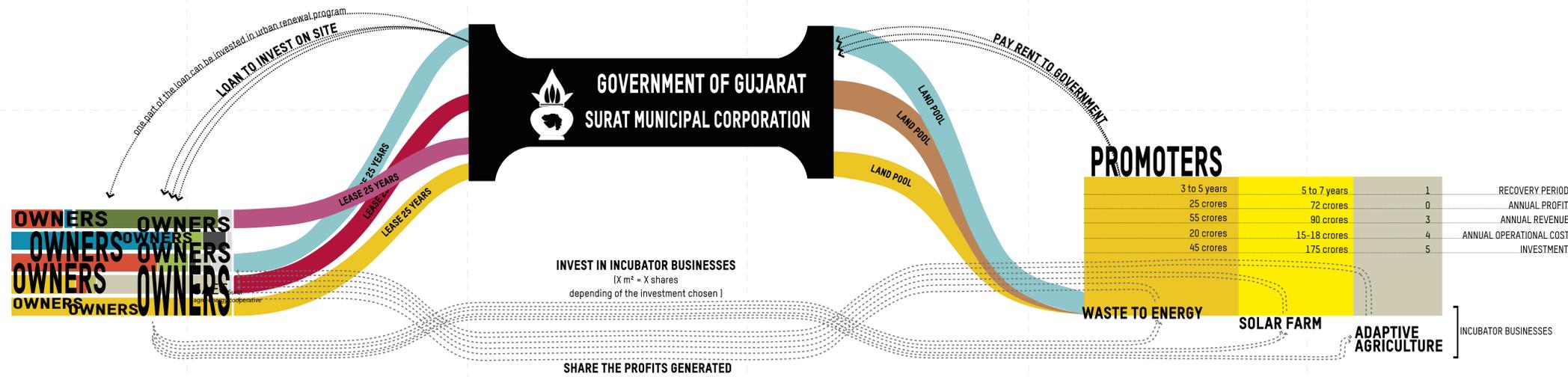
At the site scale, the development strategy is organized on a minimalist functional system :

-two railway sidings are expanded inside the site to ensure the freight access (WTE for the waste, agricultural areas for loading agro products),

-the road network is reduced to its bare minimum with the creation of an access road along the railway to the south ; the creation of a central road in the center of the site, and two parallel to ensure the liaison.

To secure the role as an incubator site, functions are arranged in a completely rational and flexible system to manage all climatic, time and energy cycles.

Apart from the treatment center (Waste to Energy) the other functions are envisaged as «independent plug», can be easily connected and disconnected from the development matrix. Thus, agricultural and energy production can use very easily (thanks to the adaptive strategy proposed) the whole site even under conditions of flooding.



TOWN PLANNING SCHEME 2.0

ECONOMIC MODEL

The area of the land is 145 HA and the number of owners is 420. By assuming that this land is what we now call the Agro-energy Park, we have proposed a matrix of solutions which require a certain lay of the land in terms of ownership and size.

There are various scenarios to consider. If the owner is giving his land out for agricultural lease, along with a share of crops, he receives about Rs. 50,000 per yr as lease amount. He could also sell his land, in which case it makes most sense for the government to buy it. But we want the owners to be equal partners in this project; hence we propose a third option.

The proposed Agro-Energy Park now has a number of incubator businesses, which includes renewable energy plants (WTE, solar etc), adaptive agro cultivation etc. In most of such projects the government provides various investments and incentives. Usually 30-50% of the project is funded by the city/state in the form of low interest loans. Here we propose the owner to be the 'direct' investor in the incubator businesses. Apart from leasing out his land, for which he will receive Rs. 50,000 per year, he will make a profit depending on the amount he invests in his choice of business, on the lines of owning shares in a company. In terms of incubation period and investment, we see the solar farms and the WTE as the highest and rice cultivation as the lowest.

Say owner X wants to invest in the solar farm, but he does not have capital to purchase the shares. He takes a loan from the government (long term, lower rates) against his plot of land. 1 acre of land will fetch him, say, 1000 shares in the solar farm, which means a larger investment (larger loan). Similarly, 1 acre of land will be worth 800 shares to invest in the WTE plant, 500 shares in the floriculture industry and so on.

The loan that X takes, he invests in the Solar farm for 25 years. But he leases out the land to the Govt. so in terms of land, the promoter deals only with the government (the usual norm) and X is only seen as a shareholder/investor. The Government now needs to pay the lease amount to X, which will help in the loan repayment. So, essentially X pledges his land as an investment and in the process with this method gives value to his land (function based) which is otherwise almost Rs.0-100 (proved before). Otherwise fallow land is now a valuable asset because it can buy him a share in a company of his choice.

Not only does X have various choices of investment, he can also choose to invest for different periods of time. For example if he invests in rice farming for 3 years, at the end of that incubation period he can choose to continue or buy more shares and invest in horticulture or the solar farm.

It is only natural that everyone would want to invest in the highest yielding business, viz. solar farms or the WTE plant. But not everyone would want to invest for long periods like 25 years. Some of us may prefer shorter term investments in smaller amounts. Hence with this scheme we can hope to achieve a dynamic matrix of owners and exchange of money.

To promote the idea of urban renewal it only makes sense that the government is the custodian of the lease because they can introduce schemes to discourage real estate investments on the given site and instead encourage investments within the city. For example, of the total number of shares X gets, 70% will be tradable within the Argo-Energy Park, i.e. invest in various slabs and the remaining 30% shares can be only used to buy real estate within the city and hence participate in the urban renewal. Though X has traded and locked his land into the virtual land pool that is created due to the Agro-Energy Park, he is now able to buy 'valuable' real estate within city which is comparatively free from flood and health risks.

For this scheme we propose to form a co-operative of owners. The Co-operative will be the Surat Agro-Energy Co-operative (SAEC). The government and the promoters will see SAEC as the investor in their incubation business. There will also be a decision taken on the upper limit of shares that will float within the SAEC, so that the profits don't get diluted with addition of more shares.

RECOVERY PERIOD	ANNUAL PROFIT	ANNUAL REVENUE	ANNUAL OPERATIONAL COST	INVESTMENT
3 to 5 years	25 crores	55 crores	20 crores	45 crores
5 to 7 years	72 crores	90 crores	15-18 crores	175 crores
1	0	3	4	5

Alga culture has number of uses and benefits. First of all Biofuel/Biomass demand is on the rise due to high prices of fossil fuel. Algae can be grown at source points of high CO2 emissions. Algal Digestion of CO2 is very important to increase the fuel capacity of the Algae, hence more valuable biomass. Due to its CO2 demand, Algae can be grown near industrial areas. The CO2 from these industries can be tapped instead of emitted.

Industrial waste water can also be used as raw material for algal growth. Hence in its growth process Algae has the capacity to treat industrial effluents before being let into the environment. Algal yield is estimated to be 60,000-240,000 Lit/HA year, way higher than most bio fuel crops like soya and palm oil.

Highly flood resistant plant. grows well in estuaries and saline conditions. Helps to prevent soil erosion during flood situation due to dense network of lateral root network. The wood is very good for biofuel. grows well in degraded lands. seeds produce oil, called karanja oil, which valuable as a bio diesel. The by-product (press cake) of Pongamia seed oil extraction process has been tested as an organic source of plant nutrients.

Generally found along the coastline of India, it has a high capacity to withstand floods and saline conditions. The terminalia herb is of immense commercial viability today due to its multiple uses in ayurvedic medicine. Gujarat is home to production of alternate medicine and the arjuna is a much sought after ingredient. Apart from preventing soil erosion and forming the peripheral foliage, the arjuna can provide added income by selling the herbs to the ayurvedic companies.

Gerbara, dutch roses and Spider lilly have high demand. Surat already has 44 green houses and with the rising demand another 22 are needed. the infrastructure on site will further help in making sure the flowers reach the markets in time and at lower costs. Floriculture in general has a very high yield, 1 acre production is equivalent to 44 acres of sugarcane.

Rice cultivation with its inherent need for water responds well to situations of waterlogging, flooding and receding. Also a huge amount of research has been done on rice cultivation in India and when combined with farmer knowledge, the obstacle of tilling the flood affected land has been successfully tackled in many areas with many species. One such being the Turanta Paddy which has high productivity on flood lands. It is not only highly resistant to water it is also very fast growing. From a mere half acre it has showed remarkable figures like 700 kgs.

The affects on productive lands today are not just natural factors but also land degradation and deforestation. All of these have contributed to changes in agro-climatic conditions. Floods are one such scenario and integrating them into our lifestyles is one way of dealing with them.

Adaptive agricultural practices is one such tool in helping people to be economically insulated from the flood but also to return to normalcy in the post flood scenario. In our site context we see 3 stages to the flood situation and its associated agricultural practices.

1. Preparedness/preventive : practices would include cultivation of rice, maize and okra. This is usually the period between June and August.
2. Living with floods : would again be conducive to rice with addition of guava, banana etc. Generally between August and October.
3. Recovery and rehabilitation : Generally between December and June, late sowing rice, coriander, mustard and peas which are responsive to partial water logging can be part of the crop rotation.

JUNE - AUGUST

Preparedness / preventive
(Early and short duration - paddy, maize and okra)

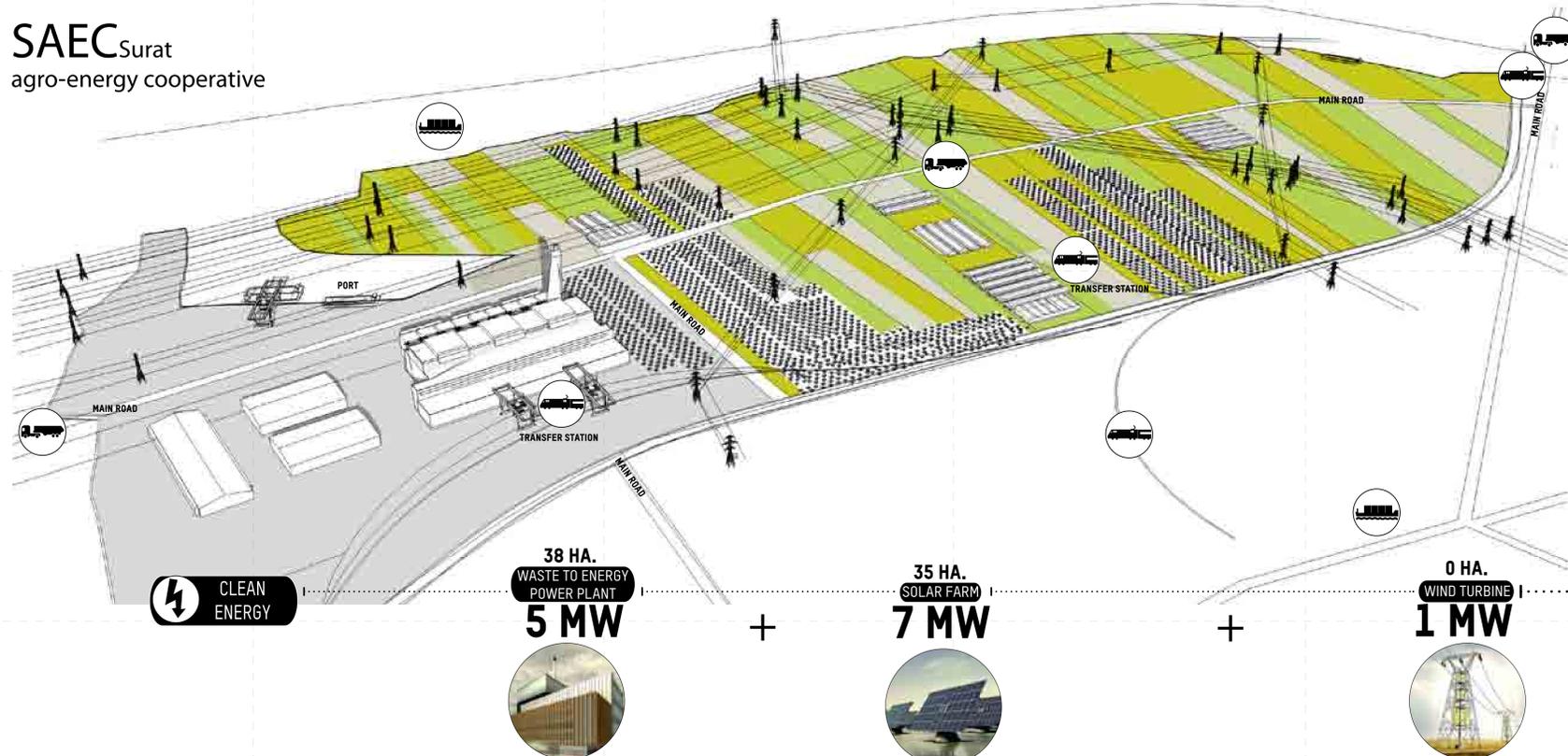
AUGUST - OCTOBER

Living with floods
(Paddy, guava and bamboo)

DECEMBER - JUNE

Recovery and rehabilitation
(Late sowing paddy, coriander, mustard and peas.)

SAEC Surat agro-energy cooperative



PRODUCTION CAPACITY
13 MW
4% of the renewable energy of Surat

-WTE plant is able to manage the complete waste of surat city viz. 980 MT/day landfill site allocated is 240 HA, where as WTE plant is 15 HA.
-It has high environmental (waste management) + ecological value(energy production).
-The cost of the plant can be recovered in 5 years.
-Cost of plant is 45 cr, maintenance+ labour cost is 20 cr and revenue per year from 800MT plant is 55 cr.
-The tariff for WTE energy is Rs.5 per unit

-The cost of setting up a solar farm is the highest. 25 cr for 1 MW on 5 HA.
-But it the most environmental option, with no emissions, hence high environmental value.
-Also a good option in Gujarat as it receives amongst the highest radiation in the country.
-The tariff for solar is high, Rs.15 per unit, hence the recovery of capital is fast too.
solar farms have high efficiency and hence loss of energy is low.
-The state of Gujarat has announced special incentive packages for solar farms.

We have a huge number of Electric pylons on our site. They provide a good opportunity for wind turbines to be clipped on to them to harness the wind at that height. Due to the large number, we are able to generate approximately 1 MW on site.