

Talukas can provide critical mass for India's sustainable development

(A short [history of Taluka Energy Policy is written here](#))

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ABSTRACT

It is suggested that Talukas in India can provide critical mass for sustainable development. A study done for Phaltan Taluka in western Maharashtra has shown that all its energy needs of electricity, liquid fuels etc. can be met by judicious use of agricultural residues and other biomass resources grown in Taluka. The study also suggests that biomass energy-based supply options have the capacity of creating substantial wealth and employment in Taluka. An energy and food self-sufficient Taluka can be a new paradigm of rural development. Various technological and policy issues needed to move this concept forward are outlined.

INTRODUCTION

The energy situation in most developing countries is quite alarming. Energy is the basis of all activities. From it flow activities in agricultural, economic and ultimately in social areas. Without adequate energy, the development of these countries is jeopardized resulting in economic stagnation and hence in tremendous internal upheavals. Consider the following facts:

1. In 1995-96 India imported about Rs. 40,000 crores worth of petroleum products. The petroleum import bill was 25% of the total export earnings. Their demand is increasing at the rate of 7-8% per annum and with increased economic growth the rate will increase further¹. It is estimated that in 2001-02 India will be importing petroleum products worth Rs. 70,000 crores².
2. In 1996 the electricity shortfall in India was estimated to be 15000 MW and the Government of India does not have money to install this additional capacity. Even if this capacity is somehow added, there are estimates that half of the population in rural areas will not have access to electricity. India requires about 140,000 MW of additional capacity by 2010 AD with an estimated outlay of about Rs. 5, 50,000 crores. Because of

tremendous shortages of electricity, the industrial growth and the general life in the country is seriously affected³. Moreover with any problems in the national grid, the rural areas are affected most since the State Electricity Boards provide urban areas with electricity on priority basis.

3. In the ghettos of Delhi and Surat (the 12th largest and the fastest growing city in India with a population of about 2 million) about 500 people died of dengue fever in 1996 and of plague in 1994 respectively. This was a direct consequence of extremely unhygienic, filthy and overcrowded conditions in them. The ghettos are composed of migrant laborers from rural areas. The plague epidemic had a very negative effect on foreign investment in India⁴.
4. In Mumbai in 1992 about 400 people died and crores of rupees of property was looted and destroyed as an aftermath of destruction of Babri mosque 2000 Km away in a remote town of Uttar Pradesh. The carnage had little to do with the destruction of an ancient religious structure but was due to a release of pent-up emotions of a population which is mostly made up of migrants from rural areas and who live in overcrowded and increasingly difficult conditions. The events in Bombay (the commercial capital of India) had a very negative effect on international and local investment⁵. The effects are felt even today.
5. From 1950 to 1995, Government of India spent Rs. 50,000 crores on surface irrigation projects including storage facilities. Till today only 50% of these irrigation facilities, built at such an enormous cost, are being properly utilized. Hence most of the country as usual goes through the cycle of floods and droughts. Besides, the increased use of inorganic fertilizers and pesticides to sustain Green Revolution is reducing the fertility of land thereby compounding the land-water management problem⁶.
6. Developing countries are spending between 2-8% of their GNP on medical costs related to declining environment. Thus in India, the numbers of premature deaths in cities due to environmental pollution are ~ 52,000/yr. and the number of hospitalizations (due to asthma and other lung related diseases) were ~ 25 million last year. These casualties cost India about Rs. 4600 crores/year which is equivalent to the cost of adding 1150 MW electricity to the grid every year⁷.

We feel that these events are a direct consequence of lopsided development model that developing countries like India have been following and which is leading to an undercurrent of economic discontent. The model is based on 50-100 year old model of

western countries', which includes centralized energy production, development of megacities at the expense of rural areas and the unsustainable husbanding of land. This development model has led to high levels of unemployment and poor quality of life in rural India and large-scale exodus of the population to big cities. This exodus is the result of lack of sustainable agriculture in rural areas.

Agriculture is mostly dependent on energy. Lack of energy is therefore the single most important reason for decline of agriculture-based activity and hence the economic activity in rural areas. A sustainable food and energy strategy for rural areas will therefore create new economic activity and can stem the desperate exodus to cities. With an ever-increasing unmet demand for goods and services, because of economic reasons, a great chasm is developing between haves and have-nots, which is resulting in conflict and a general unrest in the country. The present slow down in Indian economy is also creating large-scale unemployment and could further create frightening scenarios of social instability if timely correction is not made.

It can also be argued that the above situation and events have come about because of mismanagement by and corruption in the Indian Government. But it is our belief that the centralized big-government model in developing countries inherently leads to corruption and mismanagement.

The increase in demand for goods has also led to a sharp increase in energy usage both in urban and rural areas. With increased penetration of electronic media the citizens of developing countries aspire for quality of life available in developed countries. Sometimes one wonders whether the wasteful western quality of life is better and desirable. For example US alone is contributing 30% of global green house gas pollution⁸. However if all the people in developing countries like India and China (40% of mankind) have energy consumption similar to that in U.S. or Europe, then it will have a disastrous effect on the world economy and environment. Thus there are estimates that oil energy consumption in developing countries could surpass that in developed countries within 20 years⁹. This will create great conflict among nations and it is quite possible that in future the wars will be fought over energy resources. There is, therefore, a need for an alternative development model based upon renewable energies, which is decentralized and takes into account the aspirations of the rural population.

Historically it has been shown that the quality of life is proportional to the per capita energy consumption. Energy consumption of a country can be broken into two parts -- the

cumulative energy consumption $E_I = \int E_c dt$ where E_c is energy consumption of the country at any point in time and E_{II} = Energy consumption/capita per year. E_I goes in building infrastructure like roads, bridges, power plants, communication networks, etc. During the early and middle part of this century developing countries, because of historical reasons (most of them were colonized), had very little of E_I . Thus it is difficult for them to reach U.S. or European quality of life even if E_{II} somehow becomes available by magic. Since the lifestyle in western countries is unattainable, we should try to develop an alternative lifestyle in India. I think a lifestyle based on the maxim of “simple living and high thinking” is a possible choice. Thus our ancient philosophical thought should be used to temper our greed for resources and energy. Gandhiji showed that with minimum needs and energy he was capable of producing the highest quality of thought. This has also been the tradition of our great saints¹⁰. The Gandhi model may be difficult to follow but it shows a way towards low energy development strategy.

In India about 75% of the population lives in rural and semi urban areas. It is estimated that for the next 50 years or so the major part of population in India and other developing countries will still be rural-based. Hence rather than pumping in huge resources in urban areas where the quality of life is becoming worse by continuing on the present path, it is much better to improve the quality of life in rural areas via an alternative model based upon sustainable growth and renewable energy.

In the past, most development efforts for rural poor have focused on villages. But because of inadequate infrastructure, income generating capability and economic power, they have become sinks for development funds. There are a large number of examples world over where well meaning development efforts in small villages have not yielded the desired results. Villages are small, sometimes beautiful and generate romantic notions in the minds of funding agencies, but they are unsustainable. Cities in developing countries on the other hand may have rapid growth and development, but are generally not beautiful and have an ugly growth pattern. Therefore a middle path of Taluka based development model is being proposed for sustainable rural society. To the best of our knowledge this is the first time such a concept is being mooted anywhere.

WHAT IS A TALUKA?

Taluka is an administrative block generally comprising of about 90-100 contiguous villages and has a small town as its headquarters. On an average 8 to 10 Talukas make up a

district. For example in Maharashtra there are 30 districts and 236 Talukas. The average area of a Taluka is ~ 1000-1500 km² and its total population is between 200,000 to 250,000. The town population is about 50,000. Data on commercial energy usage show that on an average a Taluka consumes about 10-15 MW of electricity and about 10-15 million liters/year of petroleum products¹¹. There are about 3342 Talukas in India. The major economic activity in a Taluka is primarily agriculture based.

Since the geographical boundaries of a Taluka are fixed, it can be thought of as a closed biomass and rainwater basin. It is the thesis of the author that a Taluka can produce a majority of its demand of food, fuel, fodder and fertilizer from the natural resources and agro-based material available in it and hence the development can be truly sustainable. For some Talukas that do not have sufficient biomass, other energy sources like solar and wind can be used to produce energy.

WHY A TALUKA BASED MODEL ?

Societies are living and dynamic structures. In an evolutionary process they can be thought to follow the laws of a natural living system. Hallmark of evolution of a dynamic system is its size reduction; increase in energy usage efficiency; increase in complexity; possession of critical mass, and its “punctuated equilibrium” with the surroundings. In the “punctuated equilibrium” phase the system stabilizes for a certain time¹². One of the crucial conditions for the evolution of a dynamic system is the availability of critical mass. The critical mass enables the system to process materials and energy through it and hence allows it to grow. If the critical mass is not available, the system does not grow and dies off.

Societies can also be thought to be like Prigogine’s dissipative structures¹³. For example a convection cell in a body of water heated from below is a dissipative structure and is energy dependent. The resulting shape of these structures therefore depends on the quality and quantity of energy passing through them¹³. The systems possessing a critical mass grow with energy input and go through a “punctuated equilibrium” phase after which they become unstable and collapse into smaller systems. These small systems then coalesce through time and again form a critical mass and the cycle continues.

However for the societal systems to grow in a sustainable manner, certain conditions have to be fulfilled. Thus sustainable systems can be compared to a chair¹⁴. The four legs of this chair can be thought to be made of four activities : Energy, Economical, Environmental and Equity (social/cultural issues). All of them have to be of equal size for comfortable sitting and interconnected to provide stability. The base (seat) has to be of the right size. Too

big a base will make the chair sag and too small will make it unstable. Correct base size can therefore be thought of as the critical mass.

It is our thesis that because of its population size and its fairly developed infrastructure, Taluka has the ability to form a critical mass for a sustainable society for developing countries. With proper use of its agricultural and natural resources it can produce food, feed and fertilizer in a self-reliant, environmentally sound and economically attractive manner. Hence it can provide the four legs of the chair for sustainable development. As the energy and other resources available are decentralized in nature, Taluka can form an appropriate “dissipative structure” and can remain in “punctuated equilibrium” phase.

From the above evolutionary model it can also be conjectured that in future, with the increasing use of renewable energy, all societies will evolve to be decentralized, high technology dependent and rural based. Similarly the megacities will break into smaller sustainable units. India is already a rural based decentralized society. Hence instead of going the way of megacity based model, it is better to arrest this trend by introducing high technology systems in Taluka areas. These high technology systems may include internet connectivity, desktop-manufacturing units, and micropower production systems like microturbines and fuel cells.

TALUKA MODEL

India produces in its Talukas ~ 400 million tons/yr of agricultural residues which theoretically can produce ~ 53,000 MW of power via biomass based power plants¹¹. This power is 70% of the total amount available in the country as of today from all other sources³. Not only can these residues produce adequate power to supplement existing power production, but husbanding this resource properly, can also produce adequate animal feed and fertilizer. With increasing food production, the quantity of agricultural residues will also increase. Its judicious use will improve the rural economy and the quality of land. However this agricultural residue is spread all over the country and is very dispersed. This points towards decentralized power production systems.

Besides producing power, the challenge is also to maintain high quality and productivity of land so that food, animal feed, fertilizer and fuel could be produced in a sustainable manner from it. For this, water and soil conservation has to be implemented. It is possible to achieve this by rainwater harvesting and by planting of trees and grasses and general management of biomass resources in the Taluka. As the economic returns will be directly dependent on the increased biomass production, the landowners in a Taluka will take

up such measures readily. The strategy will also help increase the income of the farmers (since they will get money from residues which are presently wasted), will provide jobs in each Taluka to labourers for collecting residues and will create employment in other biomass based industries. It is estimated that each Taluka can create about 30,000 new jobs from such activities¹⁵.

Following this approach an Energy self-sufficient Taluka model was developed¹⁵. This model was developed for Phaltan Taluka. However we feel that this methodology can be easily used for other talukas in the country. The strategy for taking care of energy needs was based on biomass resources. Based upon the historical data of energy needs for Phaltan Taluka¹⁵ it was found that in 2000 AD it will require about 13×10^8 MJ of electricity and about 26 million liters of petroleum products (diesel, petrol and kerosene)¹⁵. It was established that all this energy can be easily met by biomass based power plants; production of ethanol from sweet sorghum and from existing distilleries; and pyrolysis oil production from agricultural residues and energy plantations. Electricity from biomass based power plant would replace the MSEB supplied electricity while ethanol and pyrolysis oil would replace the liquid petroleum products. The technology for producing all these products already exists^{16,17}. The details of the strategy are given in reference 15. This study also showed that with a capital input of Rs. 300 crores, Phaltan Taluka can produce wealth of Rs. 220 crores/year and provide employment to about 30,000 people year round.

This study became the basis of [National Policy on Energy self-sufficient Talukas](#) and was adopted by Government of India in 1996¹¹. As a part of this policy, presently all the states in India are collecting data on availability of biomass residues in their Talukas. This study therefore showed that it is possible to provide all the energy needs of a Taluka from its own resources thereby pointing towards sustainability.

One of the tragedies of rural areas in India and other developing countries has been the lack of production of value-added goods. This has resulted in very little remuneration to the farmers and hence the depletion of rural wealth. We feel that Taluka provides a critical mass for production of agro-based value-added products. With availability of power and raw materials (agriculture based), items such as fertilizers, chemicals, processed food products, etc., can be produced. With smart “bench-top” production facilities available in future, it may be possible to produce substantial amounts of locally consumed items. This will further help in increasing the wealth of a Taluka and creating extra employment. Recently micropower projects like gas based microturbines and fuel cells are becoming available^{16,18}. They will further usher in an era of efficient small scale manufacturing facilities.

Identification and evaluation of such cutting-edge technologies for both agro based and consumer products will help Talukas leapfrog into twenty first century.

TECHNOLOGICAL ISSUES

There are some other issues that need to be tackled before the Taluka model can become truly sustainable and self-sufficient in energy and food production. They are;

a) transportation; b) water supply; c) environmental pollution and d) fertilizer production.

A) Transportation : The Phaltan Taluka study showed that ethanol and pyrolysis oil production can take care of the historical demand of transportation for Phaltan Taluka. However that will fuel the already explosive growth of two wheelers and three wheelers. An alternative to the existing vehicles is electric cycle rickshaws¹⁹. These electric cycle rickshaws are 40% more efficient than existing petrol and diesel three wheelers and are also environmentally sound transportation systems. The electric rickshaw can easily take 2-3 passengers at 30-35 km/hr and can go to 60 km in one battery charge¹⁹. It is our belief that these vehicles can easily provide the public transport system for Talukas (20-25 km radius travel). For inter Taluka travel ethanol and pyrolysis oil fuel can run the existing fast moving vehicles like two and four wheelers and also help in reducing the environment pollution. Historically it has been shown that the structure of towns and cities is mostly guided by the transport system. It is our belief that with electric cycle rickshaws the size of existing Taluka towns can be maintained.

B) Water supply : Large number of Talukas in various parts of states like Gujarat, Rajasthan, Maharashtra, Andhra Pradesh etc. have woefully inadequate water supply. This greatly reduces the agricultural activities besides creating conditions for water borne diseases to spread. The government naturally has gone for mega irrigation projects, which have not helped the cause⁶. We think the time has come to think of private decentralized water utilities. This will include rain water harvesting and treating and recycling of used water. Just like the power utilities one can think of water utilities in a Taluka. Anecdotal data suggest that rural people are ready to pay the necessary price for assured and good supply of water. There will still be pockets of resistance for paying for water (which in most places is free and hence wasted) but that resistance can be overcome by the quality of water supply. Water on demand is a luxury in most areas of India and hence its availability can ensure proper payment. Rain water harvesting can

create good supply of water for both agriculture and household uses. Our data showed that rain water harvesting in Phaltan Taluka can yield 4.5 times more water per year than the existing canal supply¹⁵. This water can be collected in 3000 check dams of about 1 ha size and can supply water both for irrigation and household purposes in Phaltan Taluka²⁵. The cost of water from such supply will come to 1 paisa/liter. The Nira Right Bank Canal is the main source of water for both irrigation and water supply for Phaltan Taluka. A private utility in Taluka can manage this easily as compared to the corrupt public system. There are good number of examples of cooperative society managed water utilities which are coming up in India and their examples can be followed for Taluka^{20, 21}. With increased water supply there will be a tremendous increase in agricultural production and consequently in availability of agricultural residues thereby helping in both power and fertilizer production in taluka.

- C) **Environmental pollution** : The environmental pollution in Taluka areas normally comes from three sources; i) Agroprocessing industries like food processing, distilleries etc; ii) vehicular pollution and iii) sewage. Vehicular pollution can be taken care of by use of ethanol and pyrolysis oil in existing vehicles and with the use of battery powered vehicles for shorter distances. Agro industries like distilleries etc. produce tremendous pollution in rural areas and destroy the water and land resources by their effluent. In Phaltan Taluka there is one distillery of 30,000 l/day capacity, which produces about 450,000 litres of effluent¹⁵. With an average COD (chemical oxygen demand) loading of 100,000 mg/l in the effluent, its treatment can put tremendous pressures on water supply. Various technologies like solar detoxification of effluent are becoming available and can be used²². Here again the role of water utilities can become very important. The effluent can be treated and made available to farmers as irrigation water. Similarly sewage treatment can also come under the umbrella of water utilities.
- D) **Fertilizer production** : Availability of organic fertilizer is extremely important to maintain health of the soil and hence sustainability of land. With almost all the agricultural residues taken for energy generation, the fertilizer issue can become critical. However, there exists enough potential for making fertilizer from night soil and composting of weeds and vegetable waste so that the possibility of fertilizer issue to be solved exists. Our study showed that enough night soil and dung (from draught animals, poultry and sheep/goats) exists and it can be used with unutilized biomass (weeds,

grasses etc.) to produce excellent fertilizer¹⁵. Also, the increased agricultural activity (because of availability of water) will create more residues, which can go for fertilizer production. Technologies also exist whereby these materials can be composted in fast reactors^{23, 24}. With the availability of power in a Taluka it is felt that the production of organic fertilizer can become a major industry. Farmers presently sell raw dung in rural Maharashtra at a good profit. With the processing of this dung the remuneration to the farmers can increase further. There will nevertheless be a competition for agricultural residues between the power plant and the fertilizer factory. However we feel that the market forces will ultimately decide its allocation.

POLICY ISSUES

The following policy issues will have to be addressed before the above scenario can become a reality :

- a) A policy decision will have to be made by the Government of India to set up a Taluka Development Corporation and invite private sector participation in setting up power and water utilities in Talukas. A partnership of corporate sector, local NGOs and government can be a new paradigm for rural development.
- b) Policy will also have to be formulated so that the corporate sector will not only produce power/water but will also be allowed to carry out its distribution. Most of the independent power projects have been bogged down by the disputes regarding distribution. Only possession of distribution rights will allow the utilities to make money and give good service.
- c) Since both power and water production is from renewable sources (biomass and rain), existing norms, tax benefits and soft loans applicable and available to renewable energy sources should be made available to the corporate sector involved in Taluka program.
- d) Policy decision will also have to be made by municipal corporations/bodies of Taluka towns to allow only environmentally sound vehicles to ply within the town. Since the area of Taluka and the number of vehicles running are small, we think it is possible to manage this issue.

It is our thesis that in a democratic society like India, sustainable Taluka development will decentralize economic and hence political power. Decentralization of economic and political power is the best bet against economic deprivation, corruption and unaccountable ruling elite and can be the engine for internal peace, stability and development of a

compassionate society. It is my belief that development and democracy work best in a decentralized power structure, a message that was constantly preached by Gandhiji. I also feel that the Taluka plan has the potential of producing a sustainable society for 1/5th of mankind (India's population) and in the process can show the world a new way.

One of the great strengths of India is the mentality of majority of its people being satisfied with few material comforts. This strength can become very useful in the new paradigm outlined in this paper. In a democratic setup one cannot force the population into a certain lifestyle. But the existing traditions, norms, strengths etc. can be used to guide the society into sustainable living. We hope this paper will help start a debate on this issue.

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BIBLIOGRAPHY

1. Dr. E. A. S. Sarma, Secretary, Ministry of Power, Govt. of India, Personal Communication, October 1997.
2. Anupama Airy, "Oil import bill to touch Rs. 70,000 crore", **Indian Express**, Friday September 1, 2000.
3. Power Map of India 1995, Published by Central Board of Irrigation and Power, Government of India, New Delhi, 1995.
4. G. Shah, "Economy and Civic Authority in Surat", **Economic and Political Weekly (EPW)**, Vol. XXIX, No. 41, pg. 2671-2676, October 8, 1994.
5. A. A. Engineer, "Bombay Shames India", **EPW**, Vol. XXVIII, No. 3 & 4, pg. 81-85, January 16-23, 1993.
6. B. B. Vohra, 'National Resource Management for Poverty Alleviation', RGICS Paper No. 35, Published by Rajiv Gandhi Foundation, New Delhi, pg. 46, 1996.
7. Priti Kumar, "Death is in the air", **Down to Earth**, Vol. 6, No. 12, pg. 29-43, Nov. 15, 1997.
8. World Resource Institute, U.S.A; http://www.wri.org/climate/contributions_map.html.
9. C. B. Hatfield, "Oil back on the global agenda", **NATURE**, Vol. 387, pg. 121, 8 May 1997.
10. Rajvanshi, A. K., "Sustainable Development – A Gandhian Approach", Acceptance speech for Jannalal Bajaj Award 2001, delivered in Mumbai on 6 November 2001.

11. Task force report on “A Program on Biomass Based Power Plants at Taluka Level”, Ministry of Non-conventional Energy Sources (MNES), Government of India, New Delhi, March 1995.
12. Per Bak et. al., “Can we model Darwin”, **New Scientist**, Vol. 141, No. 1916, pg. 36-39, 12 March 1994.
13. Prigogine, Ilya, From Being to Becoming, W. H. Freeman and Company, San Francisco, 1980.
14. Francisco di Casti, “The Chair of Sustainable Development”, **Nature and Resources**, Vol. 31, No. 3, pg. 207, 1995.
15. Rajvanshi, A. K., “Energy Self Sufficient Talukas – A Solution to National Energy crisis”, **EPW**, Vol. XXX, No. 51, pg. 3315-3319, Dec. 23, 1995.
16. Dunn, Seth, “Micro power – changing the landscape of power production”, **Renewable Energy World**, Vol. 3, No. 6, Nov.-Dec. 2000, pg. 80-89.
17. Carl J. Weinberg, “Keeping the lights on. Sustainable Scenario for the future”, **Cogeneration and On-Site Power Production**, Vol. 2, Issue 3, May-June 2001, pg. 49-64.
18. Fairley, Peter. "Power to the People", **MIT Technology Review**, Vol.104, No.4, May 2001.
19. Rajvanshi, A. K., “Cycle rickshaws as a sustainable transport system for developing countries”, **HUMAN POWER**, No. 49, Winter 1999-2000, pg. 15-18.
20. Aloysius P. Fernandez, “Self-help groups in watershed management”, **ILEIA Newsletter**, Vol. 14, No. 1, July 1998, pg. 12-13.
21. B. K. Kakade, “Combating drought in Rajasthan through watershed Approach”, **LEISA INDIA**, Vol. 2, No. 3, September 2000, pg. 18, 40.
22. Rajvanshi, A. K., “Solar detoxification of distillery waste”, Final Project Report submitted to MNES, New Delhi, June 1999 pg. 63.
23. Virginia C. Cuevas, “Rapid composting fits rice farmers”, **ILEIA Newsletter**, Vol. 9, No. 2, pg. 11-12, July 1993.
24. V. K. Moorthy, “Going organic by recycling agro-Industrial by-products”, **LEISA India Supplement** Vol. 1, No. 1, January 1999. Pg. 12-14.
25. Agrawal, Anil and Sunita Narain (eds.), Dying Wisdom, Center for Science and Environment, New Delhi, 1997, pg. 321.

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