

BVHA Master Plan of Vrindavan

- Decision-making proposal for the municipality considering the clean and sustainable development of Vrindavan —



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1. Background

Generally about Vrindavan

Vrindavan is a town in the Mathura district of Uttar Pradesh, India. It is the site of an ancient forest which is the region where, according to the Mahabharata, the Supreme Lord Krishna spent his childhood days.

Vrindavan is **located** at 27.58°N 77.7°E. It has an average elevation of 170 metres (557 feet). The town is about 10 km away from Mathura, the city of Lord Krishna's birthplace, near the Agra-Delhi highway.¹

As of 2011 India census, Vrindavan had a **population** of 84,700. Males constitute 53% of the population and females 47%. Its population grew at 34.4% during 2001–2011. Vrindavan has an average literacy rate of 47%, lower than the national average of 59.5. It faces several public health-related challenges. 1.6% of the population is cultivator and agricultural labourer (much lower than the 51.1% average Indian employment in agricultural sector), 2.2% work for household industries and 96.2% dealing with other businesses. 12.5% of the labour force is female and 87.5% is male.² Life expectancy is at 65.9 years with life expectancy for women being 67.6 years and for men being 64.4 in India in 2011.³ There are around 50 physicians per 100,000 Indians.⁴ Vrindavan is also known as the City of Widows due to the large number of widows who move into the town and surrounding area after losing their husbands. "According to some Hindu traditions, upper-caste widows may not remarry, so many of those abandoned by their families on the death of their husband make their way here. There are an estimated 15,000 to 20,000 widows living on the streets, many of whom have spent over 30 years there. The official language is Hindi and English.

The forest cover has been whittled away to only a few remaining spots, and the **local wildlife**, including peacocks, cows, monkeys and a variety of bird species has been eliminated or are close to it. A few peacocks are left in the city but monkeys and cows can be seen almost everywhere."⁵ Vrindavan's mostly admired holy river called Yamuna.

"India is the world's most populous **democracy**. A parliamentary republic with a multi-party system. India is a federation with a parliamentary system governed under the Constitution of India, which serves as the country's supreme legal document. It is a constitutional republic and representative democracy, in which 'majority rule is tempered by minority rights protected by law'. **Federalism** in India defines the power distribution between the federal government and the states. Also Vrindavan has its own municipal board.

The Indian **economy** is the eleventh-largest economy by market exchange rates. With its average annual GDP growth rate of 5.8% over the past two decades, and reaching 6.1% during 2011–12, India is one of the world's fastest-growing economies. The GDP per capita was 1528 USD in 2011, which was doubling compared to 2005. India's recent economic model is largely capitalist. Indian labour force is the world's second-largest. The service sector makes up 55.6% of GDP, the industrial sector 26.3% and the agricultural sector 18.1%. Major agricultural products include rice, wheat, oilseed, cotton, tea, sugarcane, and potatoes. Major industries include textiles, telecommunications pharmaceuticals, biotechnology, food processing, steel, transport equipment, cement, mining, petroleum, machinery and software."⁶ In

¹<http://en.wikipedia.org/wiki/Vrindavan>

²http://www.censusindia.gov.in/%28S%28birybqk1e5ufaucigyx2u45%29%29/2011census/population_enumeration.aspx

³http://unstats.un.org/unsd/pocketbook/country_profiles.pdf

⁴Dev,S.M.; Rao,N. C. (2009), *India: Perspectives on Equitable Development*, Academic Foundation, ISBN 978-81-7188-685-2

⁵<http://en.wikipedia.org/wiki/Vrindavan>

⁶<http://en.wikipedia.org/wiki/India>

Vrindavan the unemployment rate is very high, people mainly works in the commercial sector, in the household industries as well as in the building industry and the service sector (hotels, restaurants, taxi) furthermore in the agriculture. The value added tax was introduced as an indirect tax into the Indian taxation system from 1 April 2005. Tax is collected by state officials in Vrindavan, because there is no cash register, which is a strong basis of corruption.

“The town hosts hundreds of temples dedicated to the worship of Radha and Krishna and is considered sacred by a number of **religious traditions** such as Gaudiya Vaishnavism, Vaishnavism, and Hinduism in general. Vrindavan has an ancient past, associated with Hindu history, and is an important Hindu pilgrimage site.

Vrindavan is considered to be a holy place by all traditions of Hinduism. The major tradition followed in the area is Vaisnavism, and it is a centre of learning with many Vrindavan Ashrams operating. It is a centre of Krishna worship and the area includes places like Govardhana and Gokul that are associated with Krishna. Many millions of bhaktas or devotees of Radha Krishna visit these places of pilgrimage every year and participate in a number of festivals that relate to the scenes from Krishna's life on Earth.”⁷

"The Supreme Personality of Godhead, Lord Krishna engages in pastimes there eternally. For this reason **Vrindavana is better than all other holy places**. Sixty billion sacred places reside in Mathura and Vrindavana.”⁸



⁷<http://en.wikipedia.org/wiki/Vrindavan>

⁸ Mathura Mahatma

Going into details: characteristics, difficulties and options - SWOT analysis - of Vrindavan

Local strengths and weaknesses

One of the biggest **strengths** of India and Vrindavan is its continuously growing and advanced and increasingly educated **human power**. People living in the holy town have **extremely strong religious belief** and they severely respect the **tradition**. The inhabitants of Vrindavan have **cooperative mentality** and they would willingly participate in the affairs of the community. A lot of religious festivals are organised annually. The local patriots respect exceedingly the environment and the mother Earth and they are willing to protect it. Thanks to their proximity to nature they do not want to waste and exploit the natural resources. They strictly follow the '**not wasting anything while almost everything can be recycled and used for something**' mentality.

On the other hand in the whole India there is **low life expectancy** (65.9 year in 2011 and 66.21 in 2012) due to the high rates of infant mortality (43 per 1000 live births in 2012), maternal mortality ratio (220 per 100000 live births in 2010) and bad health conditions (36% of population with access to improved sanitation facilities), as well as the poor medical care (61 current US\$ annual health expenditure per capita in 2009-2013)⁹. The main causes of death are the air- and water pollution, traffic accident, electrocution and infant mortality.

Despite the collectivism there is a **lack of awareness regarding the matters of public interest** due to the unequal education and illiteracy. Steady traditions and habits without any changes are severely important for the inhabitants even in the time of conquering globalism, although a little alteration would be needed because of the challenge of globalism. For example an engrained habits of Hindus to throw away everything, which cannot be used for human purposes, while the cows walking the streets will eat it and will not be wasted. One of the worst impacts of globalism the appearance of almost non-degradable and indigestible wrapper (e.g.: plastics, PET bottles) and non-environment friendly products (e.g.: washing powder, detergent agent, rinse, shampoo, shower gel, frying oil). This incident causes thousands death of cows eating plastics, furthermore bad health condition and air pollution by burning plastics, as well as water pollution by letting the household pollutants to Yamuna river.

Another important strength of Vrindavan is the remarkable number of **green zones and its biodiversity** with local wildlife, as well as **the existence of buildings' heritage, eye-catching temples and incredible perfect architecture**. The religious history of Vrindavan is **worldwide well-known**. On the basis of the above mentioned Vrindavan could be the most liveable town and the most attractive holy place among tourists resulting increasing tax-income and flourishing local economy.

Unfortunately the current situation is not like that. There is a **lack of mapping, functioning and maintenance of green zones** apart from a few exceptions, in addition more plants and trees are needed. A remarkable part of them is **dingy and dump** which is considerably toxic for soil and the groundwater. A moderate proportion of the buildings and temples need to be **renovated** for preserving the townscape. The considerable amount of **illegal construction** has to be eliminated. The **ugly highway pillars** need to be removed or to utilize for improving the townscape. Untreated monkey issues have appeared causing bother, irritation and health hazards for the people.

⁹<http://countryeconomy.com/demography/life-expectancy/india>

Vrindavan has a **meditative atmosphere, satisfying infrastructure** with extended road-networks, as well as satisfying public utility with good electricity and canal-network. The town owns strong handicraft, commercial and service sector, as well as building industry, furthermore traditional agriculture.

The reverse of the medal is the enormous amount of **motorised traffic resulting traffic jams** with huge **air and noise pollution**; lack of parking places; **unsatisfying quality of roads**; random blackouts; **insufficient number of garbage bins and lack of extended collection**; furthermore sinking level of ground water with **too much wasted water and bad drinking water quality**. Great amount of **untreated sewage water** pollutes the holy river day by day. Thanks to the business-related marketing and advertisement there is a **huge visual pollution due to the gigantic billboards**. Agriculture makes water pollution (salty water) as well by using urea as fertiliser and consumes a lot of water for irrigation.

External opportunities and threats

After a well-planned urban development Vrindavan could have the **chance to gain World Heritage status**, which can facilitate becoming the first target of **religious tourists**. It would result increasing tax-income, increasing demand and higher employment-rate, ultimately flourishing local economy, as well as further development of the town.

Increasing awareness of the main issues and developed opportunities for solving them via environment-friendly education and media (TV, radio channels, flyers, billboards) combined with adoptable good practices worked out by foreign expertise helps a lot in the implementation of the complex project. **Adomestic and foreign developed good practice** could spread out easily to the whole country.

Decreasing the amount of residual waste and exploiting of the residual amount **for making energy and energy efficient goods cost effectively** instead of burning would be worthy and would decrease the air and soil pollution resulting better health conditions.

Real threats are the current **corruption and the profit-maximizing economic interest**, furthermore the **engrained habits** with 'not changing anything' mentality, as well as the enduring **inequality in education** causing non-awareness of the main issues. One of the biggest risks of implementing the project can be the spreading immoral individualism, the increasing demand for energy-consuming goods and **business-consciousness instead of environment-consciousness** due to the impact of globalism.



SWOT analysis

	<i>Helpful to achieve the objectives</i>	<i>Harmful to achieve the objectives</i>
<i>Internal origin</i>	Strengths - growing and advanced human power (citizens, volunteers, pilgrims, politicians, religious leaders, celebs) with strong belief and respect of tradition, cooperativeness and participation in the affairs of the community, a lot of religious festivals are organised 'almost everything can be recycled and used for something, i.e. not wasting anything' mentality - remarkable number of green zones and biodiversity with local wildlife - existence of buildings' heritage, eye-catching temples and architecture - satisfying infrastructure - satisfying public utility - good canal network - strong handicraft, commercial and service sector, as well as building industry and agriculture	Weaknesses - low life expectancy, bad health conditions with lack of awareness regarding the matters of public interest due to the unequal education and illiteracy - burning unusable waste and plastics causing huge air pollution and health problem - lack of mapping and the bad state of green zones with untreated monkey and dog issues - moderate level of building maintenance and renovation, considerable amount of illegal construction, highway pillars at Yamuna - enormous amount of traffic causing air and noise pollution - sinking ground water level and bad drinking water quality - great amount of untreated sewage water pollutes the holy river - visual pollution, gigantic billboards, water pollution (salty water) by using urea as fertiliser
<i>External origin</i>	Opportunities - gaining World Heritage status - becoming the first target of religious tourists - increasing awareness of the main issues and solving opportunities via education (environment-friendly) and media (TV, radio channels, flyer, billboard) - adoptable good practices worked out by foreign expertise - exploiting residual waste for making energy and energy efficient goods cost effectively instead of burning	Threats - corruption and economic interest - engrained habits, 'not changing anything' mentality - enduring inequality in education causing non-awareness of the main issues - spreading immoral individualism, increasing demand for energy-consuming goods and business-consciousness instead of environment-consciousness due to the impact of globalism

2. Goals

On the basis of characteristics, difficulties and options of Vrindavan the following main goals have occurred which guarantee the clean and sustainable development of the town in the future.

a. **Improving the townscape and preserving the biodiversity via identification the green zones, as well as the potential world heritage buildings for gaining World Heritage status**

What is the **role of the green zones**? The basic elements of the clean and sustainable development are the dispersed green zones with ashrams in the town. The grooming and preservation, the environment-conscious-behaviours and eco-habits, as well as alternative solutions can be implemented in the daily life of these places; furthermore these good examples and practices can be shown to the others as well. Beside the ecological education of children these green units would be able to disseminate **awareness-raising** programs. The most receptive for ecological topics are the children whose eco-education is advantageous in short and long term as well. They can “teach” their parents and implement the lessons learned in their life later on. Awareness spots should be broadcasted regularly on local, national media. The adults would have the opportunity for “learning by doing” in small green pilot projects offered by green zones. The devotees would accept the messages of new green knowledge more easily from an ashram, than from a profane education.

Thanks to these green basic units awareness **of main issues, environment-consciousness and solving methods** can spread out, in this manner the engrained habits and 'not changing anything' mentality can be conquered.

The planting and preservation of plants and trees can be increased via green zone ashrams as well. The growing number of cleaned green zones, whose surroundings there is no eatable waste, with defending lattice frame made of recycled plastic have the opportunity to keep the monkeys away in a non-violent mode. The green zone ashrams could adopt pye-dogs and guarantee their compulsory vaccinations.

The first step is the **mapping** of the places and buildings open to the public, which the project based on. The state, size, location, and owner need to be survived. Beside this the human resource is also important.

After the identification of the appropriate locations and the competent human power the following step is the **organising of the green zones' functioning**. Volunteers, pilgrims, citizens, experts are needed for the operative tasks; furthermore politicians, religious leaders and famous people are requested to participate in the promotion of the project. The green zones with ashrams would be self-supporting, which could accept donations, non-financial contributions as well. They could offer **religious lessons, writing-education, Ayurveda-related and practical eco- and vegan lifestyle education, preventive or curative ayurvedic health advice, travelling to the holy places, authentic recreations and activities** (e.g.: festivals, ayurvedic massage, yoga), last, but not least **accommodation** even for widows and saints **with healthy delicious vegan food, and clean water**.

The **improvement of electrical network** is also needed for avoiding accidents and attracting investments.

The final objective is to **gain the World Heritage status** and becoming the first target of religious tourists. The increasing amount of taxes could facilitate to increase the level of building maintenance and renovation, and reducing the illegal construction. The presently very ugly highway pillars can be pillars of holy statues telling the story of Krishna's life in Vrindavan. Finally the billboards have to be eliminated.

The complex knowledge offered by green zone ashrams combines the ancient Vedic and the most modern ideas, which is the best answer for the challenges of this present time.

b. Reduction of the waste amount

Thanks to the tradition the local patriots do not want to waste and exploit the natural resources. Although there is the 'not wasting anything due to almost everything can be recycled and used for something' mentality in India, the amount of waste is gigantic because of the bad impact of globalism and consumer society. Earlier the natural cycle of the materials functioned well. The discarded material was consumed by animals or gave valuable mineral substances to the soil by a few years degradation. Nowadays the decomposition time of the most discarded waste (e.g.: plastic bag, plastic and PET bottle) is more hundreds and thousands year. These pollute the holy soil and groundwater of Mother Earth and the holy river, furthermore the blessed cows die in the case of eating the indigestible waste.

How the waste amount can be reduced? One of the possible solutions of the waste reduction is the indirect **consumption reduction via extra taxes imposed on products with slowly degradable packaging**. The other tool could be the **awareness-raising of costumers** to be environment-conscious via media, and education. **Producers and shopkeepers** might be motivated by financial incentives (e.g.: less VAT and taxes) to **substitute the plastic with biodegradable packaging**. A very good precedent has recently started, namely the plastic bags were changed by textile bags.

The limited amount waste should be collected in **animal-proof, selective garbage bins** for plastic, metal, glass, paper, communal garbage **installed in the street**. Municipality should employ street sweepers as well, who would collect the not properly discarded garbage separately to the bins. Professionals and non-profit organisations should regularly pick up and **transport the collected garbage to the landfill for recyclable waste**. This kind of waste is used as cost-effective raw material of recycled plastic products. The collected residual non-recyclable waste has to be transported regularly **to the official dumping ground** for long term use, whose waste is used for making renewable energy. The municipality would be responsible for the bin installation, trash emptying and official garbage transport to the proper dumping. **More illegal dumping must not be made** by the municipality.

First step is the **mapping of illegal dumping and recultivate them, afterward the location of the official dumping** dealing with recycling and the other dealing with producing energy **should be laid down**. **Finally the necessary operating facilities should be built** (e.g.: rectifier, masticator, machinery of injection molding, granulation and extrusion, furthermore power plants) and staff should be employed which would create new jobs. The extra taxes and subsidies contribute to the cost and expenses of the system.

In the future the above mentioned system will face a lot of challenges. The demand on goods will increase due to spreading out of the consumer society. The focus should be more on the reparation of the products instead of throwing them away and buying a new one particularly in the case of electrical devices. In one word the present **"not wasting anything" Indian mentality should be preserved**.

The government and municipalities should show good pattern with central **green public procurement**. This is an obligation of public-sector agencies and government departments to purchase resource-efficient and environment-friendly, sustainable eco-products.

Due to the waste reduction and the dissemination of environment-conscious mentality adapted to the capitalism, the other goals, namely the reduction of the water and air pollution, are more easily reachable. That is why the two key aims are to complete the awareness-raising of the local patriots and the waste reduction.

c. Reduction of the water pollution

The main polluters of the water are the population, the agricultural sector and the industry. The produced waste by inhabitants pollutes the water in two different ways. The dangerous wastelying in the streets **infiltrates into the groundwater and the untreated sewage water goes directly into the holy river.** The sewage water has to be lead into a **wastewater treatment plant** then filtered and cleaned before going into the holy river.

On the **consumerside** the produced environmental burden has to be decreased, therefore biodegradable washing powder, detergent agent, rinse, shampoo, shower gel should be applied. The **waste frying oil has to be collected** by the households and restaurants instead of let it leaking to the water. It is mainly used for producing biodiesel. The human faeces also pollute the ground water and river, therefore **public toilets must be set up** whose compost would be transported and exploited by a biogas plant. The water from tap and manual water pumps in streets in Vrindavan is not drinkable. Households need **small water filtering system** whose frame can be made from recycled plastic.

Beside this the ground water becomes being salty because of using urea as chemical fertiliser in the agriculture. The industrial plants let their waste go into the river or leave it in illegal dumping without permission. It could be **compulsory for farmers to use only natural fertiliser**. The main polluting actors of the industry should **apply water- and environment-friendly production methods**. If not, then the **“polluters should pay” principles** should be introduced and extra tax should be levied by the government on the main actors. The quality of drinking water, which comes from the insufficiently treated Yamuna and from the polluted groundwater, could be improved by proper waste management described above.

In Vrindavan there are a lot of **lakes**, each of them consists a **significant amount of alga**, located next to the ashrams. This situation need to be treated as well, which gives an opportunity to produce biofuel and renewable energy from algae, as well as to preserve these areas in their present form.

Another important question of this section is the **reduction of water consumption** mainly of the hotels and the agricultural irrigation, as well as industry. No water using dry toilets should be applied by the hotels and accommodations. The generated and transported compost could be used first by biogas producing plants then by the agriculture instead of chemical fertiliser. The other main factor of water consumption is the laundry in the hotels. The collected water from bathrooms being in a separated water pipe can be cleaned — via microbiological treatment — by the own filter system of the hotels. This cleaned “gray water” quantity would be able to satisfy the water need of laundry.

Farmers would be able to **use the cleaned water produced by wastewater treatment plant and the rainwater collected in tanks and containers for irrigation** instead of using drinkable water. **Industrial companies** could **implement “less water consumption” technological innovations** in their production processes. Government should offer subsidies or increase the public utility expenses (fees of water supply, and sewerage system) for companies to make the actors economical interested in this kind of water conscious innovations.

To **make people conscious about the importance of clean water**, centralised and decentralised awareness-raising programs must be made via media and education (school system, green zone ashrams).

Everyone must understand that water is life, which must not be wasted and it is a must to keep it clean. Dirty water is unhealthy. Therefore a professional water management is the most important mission.

d. Reduction of the air and noise pollution

The cause of the air pollution is the enormous emission of the traffic and traffic jams, the unfavourable emission characteristic and noise impact of the fossil fuels consumed by motorized vehicle, as well as the poisonous gases of the burning dangerous waste. These three main roots have to be eliminated resulting in treatment of more than one issue at the same time.

Traffic must be controlled by high **excise taxes** on fossil fuels, and levying **expensive parking fines** in the old town, as well as creating **one-way streets** in Vrindavan, furthermore **restricted access of the town for cars and trucks** to a limited period of the day. These measurements could decrease the number of the traffic accidents as well.

To decrease the emission of cars, busses and trucks is an appropriate option the **compulsory blending of second generation biofuels** as a bio-component in fossil fuels sold by petrol station. The feed stocks used in producing second generation biofuels are generally not food crops. These are for instance, waste vegetable oil, lignocellulose feedstock exploited from grasses and agricultural waste, furthermore human or animal excreta.¹⁰ One of the main actors in the downtown traffic is the **rickshaws**, which must be **fully based on electrical drive** instead of fossil fuels consuming motor. The **small food-transport vans** must be **based on CNG and biogas drive**. The biodiesel produced from waste frying oil and the biogas produced by the biogas plant can contribute to these goals.

Horning must be prohibited in downtown, especially near the ashrams and temples. The **installation of noise barriers made from recycled plastic** can eliminate the residual noise.

The introduction of a proper waste management eliminates the burning of dangerous waste in the streets and their poisonous gases. Burning waste would be permitted only in power plant for producing energy.

These changes would reduce the air and sound pollution, as well as preserve the meditative atmosphere in Vrindavan. The life expectancy of the inhabitants can be higher thanks to the improving health conditions. Finally they can contribute that Vrindavan becomes one of the favourite targets of religious tourists. **Now this is the best time to step forward.**



¹⁰<http://biofuel.org.uk/second-generation-biofuels.html>

3. Options for reaching the goals and solving the issues

Goal a.) Improving the townscape and preserving the biodiversity via identification the green zones, as well as the potential world heritage buildings for gaining World Heritage status

What to do?

- **The first step** is the **mapping** of the potential green zones and buildings open to the public, which the project based on. The state and condition, size, location, and the owner need to be survived. Then the competent human power needs to be identified. The following step is the **organising of the green zones' functioning**. The other important step is planting and preservation of plants and trees, as well as pye-dog adoption made by green zone ashrams.
- **Concerning the monkey issues** the production of **defending lattice frame made of recycled plastic**, whose top there are many plastic nails like the hedgehog to disturb monkeys in climbing. The **prickly, but animal-safe plastic "hedgehog" nails can be produced in a string or in a shape of matrix**, separately from the plastic lattice frame. It can **be installed on the rooftop of buildings and edge of window shades to easy inhabitants and shopkeepers from monkeys**. Plastic recycling plant¹¹ with machinery of masticator, granulation, rectifier, injection molding and extrusion is able to produce this niche recycled product.

The holy statues telling the story of Krishna's life in Vrindavan, which would be installed to the highway pillars at Yamuna, made of recycled plastic produced the plastic recycling plant as well.

- **Maintenance, renovation of electrical network, as well as temples are needed** for reaching the final objective, namely gaining World Heritage status and becoming the first target of religious tourists.
- **Local advertisement tax** should be imposed **on the gigantic billboards** damaging the townscape.

Cost and expenditures

- The green zones with ashrams would be self-supporting, which could accept donations, non-financial contributions and subsidies as well.
- The cheapest CE standard plastic recycling machine costs USD 3,000-10,000, a mid-range machine costs USD 10,000-20,000 and the top class machines cost USD 50,000-100,000. The payback time is within 10-15 years depending of the purchase amount and the machine type.¹²
- The increasing amount of taxes would be able to increase the present moderate level of building, and reducing the considerable amount of illegal construction.

Socio economical impacts

- It creates a few tens of jobs, generates GDP growth, higher tax incomes, and reduces the illiteracy.

¹¹<https://www.youtube.com/watch?v=Bo0fQzly-fs>

<https://www.youtube.com/watch?v=id-hrTgOfU>

¹²<http://www.alibaba.com/showroom/cost-of-plastic-recycling-machine.html>

Goal b.) Reduction of the waste amount

What to do?

- Consumption reduction of products with slowly degradable packaging as well as other environmentally harmful products (e.g.: alcoholic drinks, egg, fish, and meat) by **higher value added tax or an extra environment protection tax** imposed on them by the central government. **Producers and shopkeepers** might be motivated by financial incentives (e.g.: less VAT and local taxes) to **substitute the plastic with biodegradable packaging**.
- **Awareness-raising campaigns** via media, and eco-education can increase the environment-consciousness of the costumers.
- **Municipal installation of animal-proof, selective garbage bins** made from recycled plastic in the streets. The garbage should regularly pick up and **transport**.
- **Mapping of illegal dumping and recultivate them, afterward laying down the location of the official dumping** dealing with recycling and the other landfill dealing with producing energy.
- A **plastic recycling plant** (public company, or business corporation gaining purchase order via green public procurement) located near to the official dumping would **produce recycling goods**, for example: **animal-proof garbage bins, noise barriers, warm clothes, plastic frame of small water filtering system, monkey proof defending lattice frames and prickly plastic "hedgehog" nails in a string or in a shape of matrix**. These two last products installed on the rooftops keep the monkeys away from the territory of inhabitants. It disturbs the climbing and jumping of monkeys.

Energy efficient goods like window shades, transparent walls with honeycomb structure can be produced from recycled plastic cost effectively as well. **Outdoor window shades** can prevent the overheating of buildings because of the solar energy in the summer time and reduce the electricity cost significantly decreasing the usage of air-condition systems.¹³

The **transparent walls with honeycomb structure installed on the southern wall of the buildings** (e.g.: hotels and other accommodations) are transparent insulation in passive solar walls. From autumn until spring it lets the solar radiation going to the absorbent black-painted wall which is getting to be warmer. "This energy can be used either by venting the warm air inside, or by allowing the heat to conduct passively through the wall. Transparent insulation materials including glass honeycombs can provide significant energy savings. On cold sunny days, no additional heating may be required, yet control strategies are necessary in summertime to minimise overheating."¹⁴ In the summertime the transparent wall needs to be covered and the solar warm is less then without the transparent wall. It reduces also the electricity cost significantly decreasing the usage of air-condition systems.

¹³<http://energy.gov/energysaver/articles/energy-efficient-window-treatments>

¹⁴http://www.designingbuildings.co.uk/wiki/Transparent_insulation#Transparent_insulation_in_passive_solar_walls

- **The waste dumped in the other official dumping ground** is used for producing renewable electrical energy by a **waste burning power plant**. The heat energy of the steam generated by burning waste is transformed by the turbine to mechanical energy, which is transformed to electrical energy by the generator. The dangerous components of leaving waste gas are filtered.
- Central or local **green public procurement of resource-efficient and environment-friendly, sustainable eco-products** made by the government and its municipalities.

Cost and expenditures

- The cost of the awareness-raising campaigns could be financed by the increased amount of taxes.
- The negligible expenditure of animal-proof, selective garbage bins installation and the transport of waste to the landfills is covered by the increasing tax income.
- The payback time of a plastic recycling plant is within 10 years depending of the purchase amount and the machine type, i.e. the cost and expenditure will be paid back within a decade.
- The total cost of the official dumping ground and waste burning power plant is 0.10-0.15 USD per kWh (the investment cost is the half of it) based on the data from the western part of the world and the payback time is about 15 years depending of the electricity price in the future. The cost is much lower in India because of the lower wages and raw material prices. The required capacity depends on the estimated quantity of feed stock (non-recyclable garbage). The maximum capacity of this plant is 5-10 MW, because of the limited amount of non-recyclable garbage which can be added dried sewage sludge.

Socio economic impacts

- The staff employed by municipality as street sweepers, the waste transport company, plastic recycling plant and official dumping grounds would create a few tens of new jobs. The estimated total employment of a waste burning power plant is 43 per MW of capacity based on India's renewable energy sector. The direct employment is 15, and the indirect is 28.¹⁵
- The electricity consumption would be reduced by energy efficient goods made of recycled plastic.
- The life expectancy grows because of the improving health condition of the inhabitants.
- The generated renewable electricity causes GDP growth, as well as higher taxes income.
- The external cost decreases because of the smaller environment pollution in the future.
- The green public procurement of resource-efficient and environment-friendly, sustainable eco-products decreases the budget cost of state consumption and the level of corruption can be sunk.

¹⁵ IRENA: Renewable Energy – Jobs & Access, 2012 June, page 26.

Goal c.)Reduction of the water pollution

What to do?

- **Production and application of biodegradable goods** (e.g.: packing, washing powder, detergent agent, rinse, shampoo, shower gel) via awareness-raising campaigns and financial incentives of the tax-system.
- **Collection and utilisation of the waste frying oil** produced by the households and restaurants instead of let it leaking to the water. The waste frying oil after purifying is recyclable **for producing biodiesel** via the process of transesterification (methanol is added to the purified and heated oil in alkaline).¹⁶ The best option if the fried oil is bought for a limited amount of money and collected by the patrol stations and transported to the biofuel plants. (The joint venture of the Indian Oil petroleum company and Creda is a major player in the biodiesel business which has initiated large-scale biodiesel projects on different models in Uttar Pradesh.¹⁷ Bharat Petroleum can be another potential partner as well.)

There is a **significant amount of alga** in the lakes of the ashrams which can be **utilised to produce biodiesel** as well. After the harvesting of the grown up algae comes the processing (dehydration, compression, straining and drying) and oil extraction before gaining biodiesel from different alga types (*Botryococcus braunii* and *Neochloris oleoabundans* in tropic lakes, *Dunaliella* and *Nannochloropsis* in tropic salty lakes).¹⁸ The estimation of the biodiesel potential from producing alga can be performed in the frame of a demonstration project in Vrindavan. These two options suit the country aims to replace 20% of the country's diesel requirement with biodiesel in accordance with the National Biodiesel Mission (NBM) by 2012.¹⁹

- **Public toilets must be set up** whose compost is transported and exploited by the **biogas plant**. Biogas is mainly used as environment-friendly second generation biofuel in vehicles with CNG drive. Biogas is gained from human or animal faeces, waste of agriculture, sewage sludge and communal waste. The optimal location of the biogas plant is between the official dumping ground and the wastewater treatment plant. The basic requirement of biogas production is the existence of organic materials, acetogenic and methanogenic bacteria, furthermore steady temperature and compounding in the fermentor. The 70 % of the resulting material is methane and 30 % is CO₂. CH₄ needs to be purified and compressed to 220 bar before using it as biofuel.²⁰
- The sewage water filtered and cleaned by a **wastewater treatment plant** before going into the holy river of Yamuna. The wastewater treatment plant operates on the basis of environment-friendly and proven cleaning technologies like mechanical and biological filtration, producing energy by usage of the energy potential of sludge and solid waste at the same time. The produced biogas can be used as biofuel after purification and compression, but it can be transformed to electrical energy in an environment-friendly and cost-efficient method.

¹⁶<http://www.cefs.ncsu.edu/whatwedo/energy/biodieselpembroke.pdf>

¹⁷<http://www.icbl.co.in/aboutus.html>

¹⁸ „Microalgae for biodiesel production and other applications: A review” by Teresa M. Mata, António A. Martins, Faculty of Engineering, University of Porto, Portugal; Nidia. S. Caetano Polytechnic Institute of Porto

¹⁹http://en.wikipedia.org/wiki/Biofuels_by_region

²⁰<http://www.biogas-renewable-energy.info/>

- **Government has to combat seriously against water pollution as well.** Only the strict regulation is able to ensure that the two main polluters restrain their polluting activity. The **obligate usage of natural fertiliser** (animal dung, the remained material of the biogas plant, cleaned sewage sludge) should be **compulsory for farmers. The main polluting actors of the industry should apply water- and environment-friendly production methods.** If not, then they have to pay high sum of penalty according to the **“polluters should pay” principle** .

Government should offer subsidies or municipality should increase the public utility expenses (fees of water supply, and sewerage system) for companies to make the actors economical interested in water conscious innovations. **Farmers have to use the cleaned water produced by wastewater treatment plant and the rainwater collected** in tanks and containers for irrigation instead of using drinkable water. **Industrial companies should implement “less water consumption” technological innovations** in their production processes. Companies operating in service sector (hotels and accommodations) have to decrease their water consumption as well with dry toilets and “gray water” consuming laundries.

- Awareness-raising programs **make people conscious about the importance of clean water.**

Cost and expenditures

- Production of biodegradable goods is not significant higher than the regular one.
- The total cost of biodiesel production including investment cost, maintenance and operating cost is 0.1-0.13 USD per kWh based on the data gained from IRENA.²¹ The cost situates in the lower number of the range in India because of the lower wages and raw material prices. The net present value of this project is positive, that is why it is worthy to invest money in it.
- The total cost of biogas production is 0.09-0.14 USD per kWh based on the data of IRENA. The cost situates in the lower number of the range in India because of the lower wages and raw material prices. The net present value of this project is positive, that is why it is a profitable investment. The required capacity depends on the estimated quantity of feed stock. The maximum capacity of the plant could be 0.5-1 MW.
- The total cost of wastewater treatment plant is 0.11-0.14 USD per kWh based on the IRENA's data, but the cost falls in the lower part of the range in India. The required capacity depends on the estimated quantity of the sewage water. The wastewater treatment capacity of the plant is 3,500 m³/d which equals to 0.9 million m³ per year.

Socio economic impacts

- Higher life expectancy because of the improving health conditions.
- The staff employed by the plants would create a few tens of new jobs.
- The produced biofuels and generated renewable electricity causes GDP growth.
- The external cost decreases because of the smaller environment pollution in the future.

²¹<http://www.irena.org/menu/index.aspx?mnu=Subcat&PriMenuID=35&CatID=109&SubcatID=158&RefID=158&SubID=170&MenuType=Q>

Goal d.) Reduction of the air and noise pollution

What to do?

- **Control of traffic** by high **excise taxes** on fossil fuels, and levying **expensive local parking fines** in the old town, as well as creating **one-way streets** in Vrindavan, furthermore **restricted access of the town for cars and trucks** to a limited period of the day.
- **Rickshaws** must be **based on electrical drive** instead of fossil fuels consuming motor and the **small food-transport vehicle** must be **based on CNG and biogas drive**. The advantage of these two biofuels is the sustainable emission characteristic and the less noisy engine performance. The biogas produced from sewage water contributes the emission reduction and the decreasing consumption of the fossil fuels as well. Awareness-raising should be made about the advantages. **This type of drive methods require a few electrical and biogas charging stations in the town.**
- **The compulsory blending of second generation biofuels can be increased until 20%** in accordance with the NBM. This extent of blending does not require any technical changes in the motor. The blending part can be biofuel produced from waste vegetable oil, algae in the case of diesel, or lignocellulose feedstock exploited from grasses and agricultural waste in the case of gasoline.
- **Horning must be prohibited in downtown**, especially near the ashrams and temples. The installation of noise barriers made from recycled plastic can eliminate the residual noise.
- The **introduction of a proper waste management** described above **eliminates the burning of dangerous waste** in the streets and their **poisonous gases**. Burning waste would be permitted only in power plant for producing energy with filtering system. The **elimination and recultivation of the illegal waste dumping causes decreasing emission**.

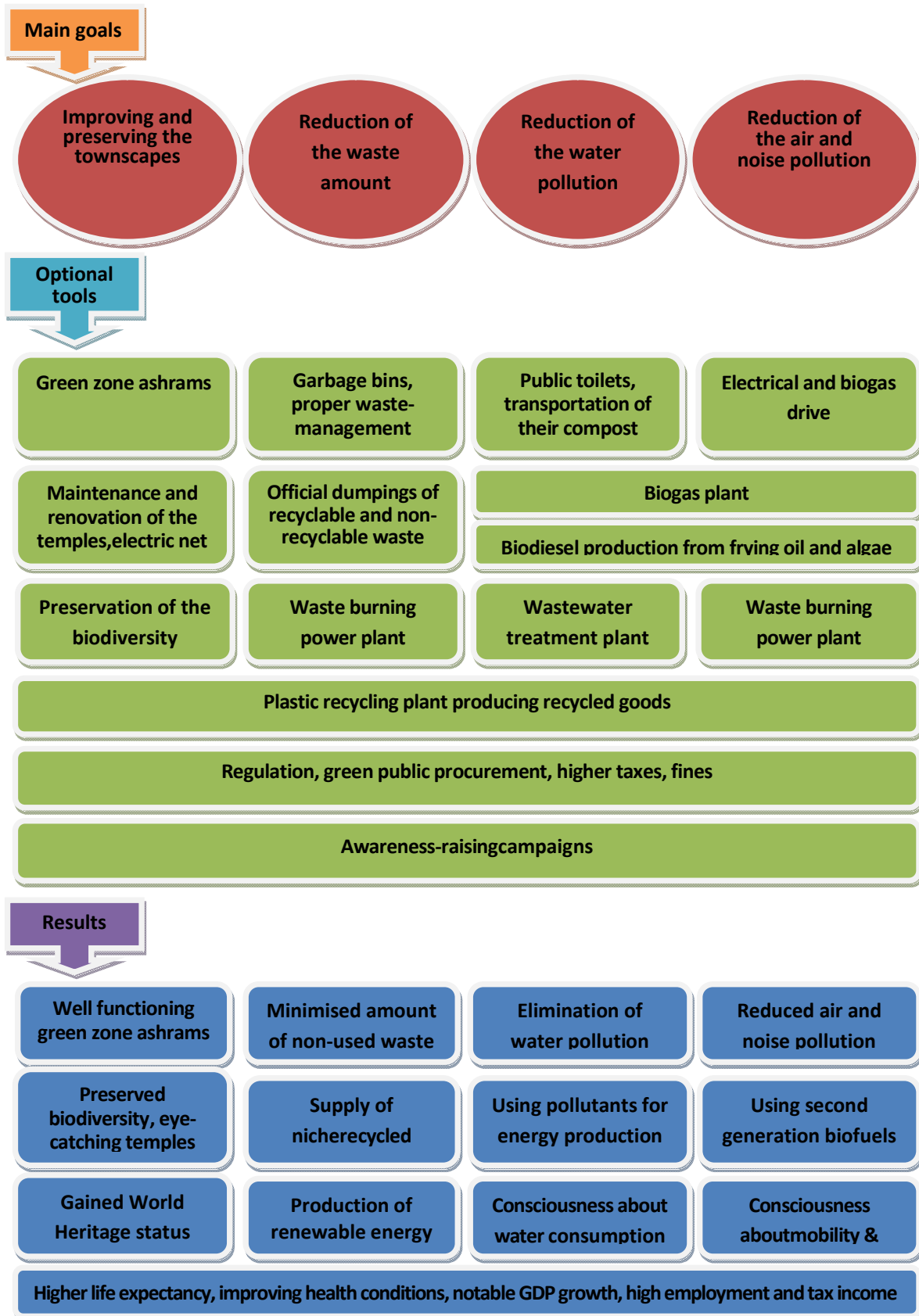
Cost and expenditures

- The additional price of an electrical drive is 0.9-2.6 USD per MJ in the case of a new car based on the data from the western part of the world. The cost is much lower in the case of Indian rickshaws. The additional cost of the motor conversation from gasoline or diesel to CNG drive is 0.12-0.36 USD per MJ in the case of van. The additional price of a CNG drive is 0.87-1.45 USD per MJ in the case of a new van. These data are based on the data from the western part of the world, so the additional costs are lower in India.
- The price of an electrical and biogas charging station is 42,000 USD and 84,000 USD based on the data from the western part of the world, but the costs are lower in India.

Socio economic impacts

- The options — mentioned above — preventing air and noise pollution have positive impacts on life expectancy, human health conditions, GDP growth, employment rate and tax income as well.

Visual graphics of the potential opportunities for the reaching the main goals



4. Conclusions

As described above we could see how the combination of the ancient Vedic and the most modern ideas gives answer to the challenges of this present time. Vrindavan needs to keep its old tradition and adopt the latest technologies for the cleandevlopment of the town. In this matter Vrindavan is able to become a real knowledge, innovation and religion based economy.

Ergo — beside the power and knowledge of the community, as well as the preservation of the historic townscape and the biodiversity — proper waste- and sewage water management, furthermore different type of power plants, as well as the usage of advanced biofuels are needed.Vrindavan has a real opportunity for the cost effective, sustainable development in balance with the nature and gaining World Heritage status, as well as becoming a naturally flourishing town.

People have to be conscious about the main global issues and the possible alternative methods for solving them. This is the only way of struggling against air- and water pollution, and the hazardous effect of theconsumer societyand globalism on the mother Earth.

The conception described above ensures that Vrindavan with its unique identity becomes the basis of the Indian culture dueto its traditional wisdom, as well as eternal value system, and serves as asustainable and clean example for the whole World. The holy town could bean equivalent place to Jerusalem and Mecca continuing Mahatma Gandhi's and RabindranathTagore's heritage,whichwere about the showingand spreadingout of India's valuesto the whole World.



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21. Photo made by Mrs. Krisztina Grünwald, Mr. Zoltan Leveles Hadijan and Mr. Laszlo Takacs

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