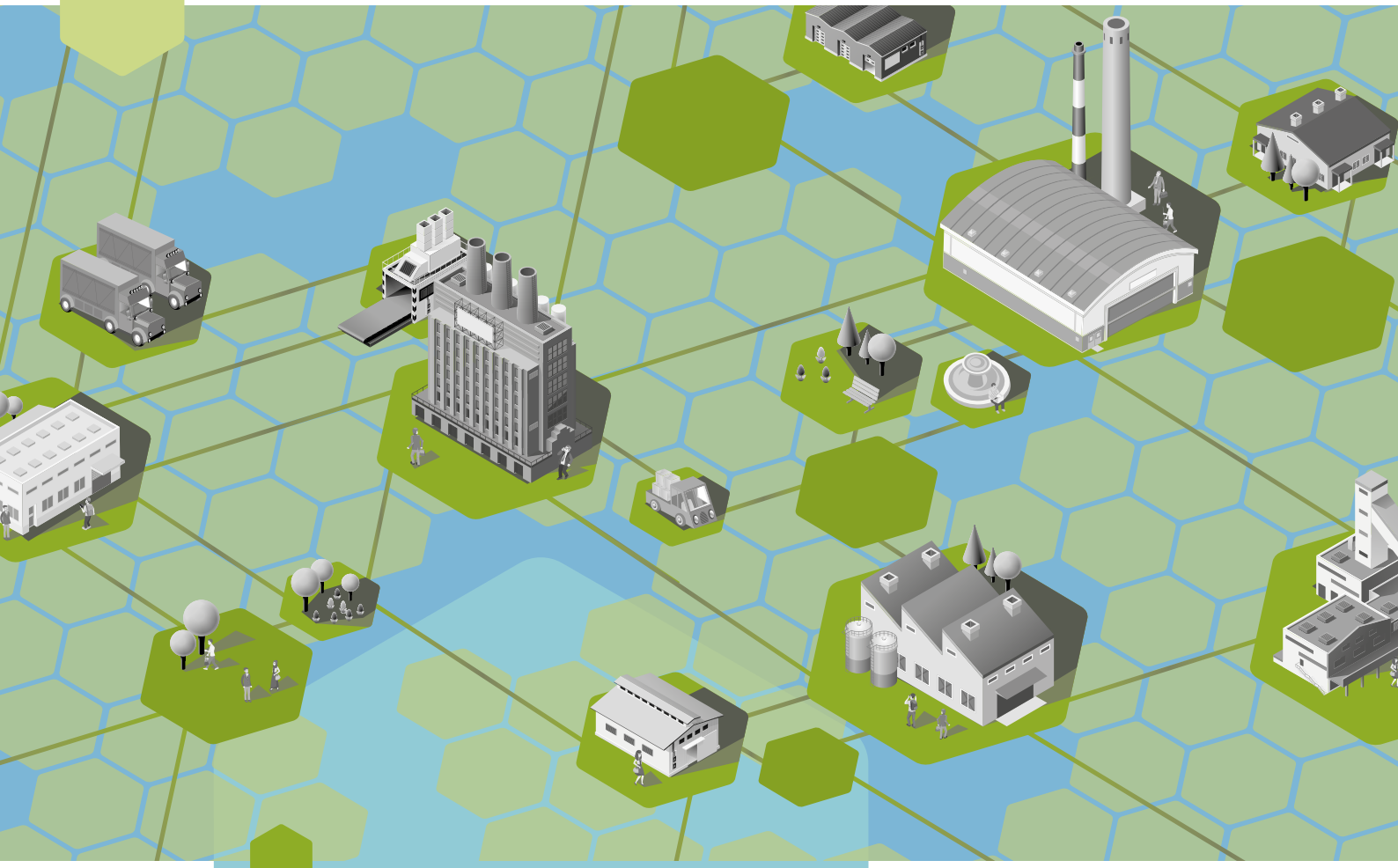

Guidelines for Sustainable Industrial Areas (SIA)

Version 1.0

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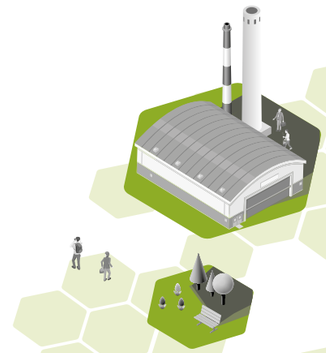
WORKING GROUP SIA Sustainable Industrial Areas



Published by

Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

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Printed by:

druckriegel GmbH, Frankfurt

Place and date of publication

Eschborn, October 2015

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SIA WORKING GROUP Sustainable Industrial Areas

Preamble

The following proposed “SIA Guidelines” for the development of Sustainable Industrial Areas focus on the management level of an industrial zone or park. They intend to guide the industrial area as a whole to become more sustainable and are less dealing with the individual companies. The sustainability performance of companies inside the area is assumed to be guided by respective sector or company related rules or standards. However, a sustainability framework on park level is likely to initiate and promote also positive changes on company level.

The guidelines are directed to industrial park operators, planners of industrial areas, public administrators in charge of regulating industrial areas and experts advising on industrial development. The guidelines can only provide a first overview of what sustainability in an industrial area is all about. They want to highlight the most important sustainability aspects for planning and operating an industrial area or for elaborating a legal framework for sustainable industrial area development. This needs of course further specification and precise definitions in particular if developing

- a legal framework for sustainable industrial areas,
- a national standard for sustainable industrial areas,
- indicators to monitor the fulfilment of the standard and
- rules for designing and operating sustainable industrial areas.

In all cases it might be necessary and advisable to foresee a staged approach in defining several performance levels (e.g. minimum, medium and advanced).

Guidelines for Sustainable Industrial Areas (SIA)

Content

1. Organisational Features

1.1. Site Master Planning

Holistic planning approach integrating environmental, social and economic issues.

The successful implementation of a sustainable industrial area requires a holistic and detailed planning process that considers equally environmental, social and economic issues from the beginning. Site Master Planning is a tool that likewise applies to new-planned industrial parks and old ones that need to be retrofitted and guides the entire process from the site selection until the inauguration.

The planning of new industrial sites must be preceded by an honest needs analysis. Having taken the decision to develop an industrial area, a suitable site must be selected with great carefulness. The availability of raw materials and existing industries, proximity to transportation and energy networks, favourable tax and business conditions as well as the presence of a suitable work force are decisive factors.

The negative environmental impacts arising from the construction or rehabilitation of an industrial area need to be assessed by tools like the Environmental Impact Assessment (EIA) which is usually regulated by law. The EIA also needs to consider risks related to biodiversity losses and to degraded ecosystems (cf. 3.5) and to climate change such as floods, extreme weather events or water scarcity (cf. 3.7). On the basis of the analysed climate and environmental risks, their implied costs can feed into the designation process and can be compared to the projected benefits of the industrial site - allowing for informed decision-making. Wherever possible, sites that are already commercially in use the reactivation of brownfields should be considered before natural terrain has to give space to industrial development.

Based on a clear development concept (size and type of the industrial area, type of industry sector, envisaged mix of companies, service facilities needed, needs for environmental protection, required social facilities, etc.) master planning needs to comprise the following features:

- Integration of industrial area in surrounding infrastructure
- Efficient land use (cf. 3.6)
- Infrastructure provision (cf. 2.3) and transport system (cf. 2.7)
- Energy generation and distribution (cf. 2.4)
- Water and wastewater management (cf. 2.6)
- Waste management (cf. 2.5)
- Disaster Risk Management (cf. 1.7)
- Social infrastructure (cf. 4.1)
- Promotion of biodiversity (cf. 3.5).

The elaboration of the Site Master Plan considers all relevant land rights and environmental laws as well as stakeholders' input, which has to be sought adequately (cf. 1.5). Future developments such as extensions should be considered in order to prepare infrastructure accordingly and reduce costs in the future.

During construction attention needs to be paid to worker safety. Adequate working and safety conditions as well as accommodation for the workers need to be provided and documented by the site developer.

1.2. Management Structure

Distinct unit responsible for the management of the industrial park

For an industrial area considered to be well managed, well organised and prepared to implement sustainability measures, a management structure is generally required. This structure needs to be endowed with clear mandates, an adequate budget line and should be in the position to define by-laws compulsory inside the industrial park (e.g. park charter, corporate social responsibility charter, environmental, occupational health and safety, social standards, etc.). Enforcement of such rules must be monitored (e.g. by Key Performance Indicators). All companies operating in the park have to agree to these given rules and sign respective documents.

Typically, management tasks are taken care of by a unit that acts as administrator and service provider responsible for all organisational features and some other features listed below. Usually, this organisation would be responsible for designing and planning of the entire area, selling or rental of plots, administrative management, provision of services to the companies, distributing information, and monitoring of compliance to the given rules and regulations. In order to assure these tasks, the management has to dispose of the respective organisational capacities and technical know-how or have access to external capacities. The legal and organisational setup of management units can differ considerably from each other. Depending on the existing context and policy framework management models may be: Public administration unit, private association, state-run company or private company.

Having the power to enforce rules and regulations and being backed by an independent budget line to solve problems promptly and adequately the park management unit is able to act also as focal and mediation point in case of problems arising among the park community and between the industrial area and neighbouring stakeholders. In summary, the management takes care of all issues needed to develop the industrial area in a sustainable way, to attract investments and to provide attractive working conditions.

1.3. Service Orientation

Pro-active service provision of the park management, Business Centre – one stop service

Despite common practice, management units of sustainable industrial areas should regard themselves as service providers rather than as administrative units. This needs a clear understanding about the needs of the costumers who are primarily the resident companies inside the industrial areas but also the municipal and state-level administration and the surrounding industry and population.

In a pro-active approach, needs and demands have to be identified and (new) solutions offered. This requires a permanent observation of the political and economic framework conditions as well as the requirements of the market and the companies and the adaptation of the support the park management can offer. While this is important to assist the day to day operations in the park, it is also needed to present the park in an attractive way in the search for new investors.

Companies looking for a new production site require many services that are often time and management consuming and difficult to obtain individually. If the park can offer the required business development services in form of an "One-stop-shop" an important competitive advantage is obtained. This is especially important for foreign investment in countries with low performance on ease-to-do-business indices [1].

Based on an analysis of services requested by companies in the park and the willingness to achieve relevant standards on customer orientation (e.g. ISO 9001, CRM) certain actions have to be taken. This can be the establishment of a web-based information platform, advisory meet-

[1] *Index created by the World Bank. Higher rankings (a low numerical value) indicate better, usually simpler, regulations for businesses and stronger protections of property rights.*

ings and sessions that bring together the different groups of stakeholders where common interests are identified and joint actions planned, and the provision of demanded services. Together, a comprehensive service provision system is formed which is regularly monitored and continuously upgraded.

1.4. Networking & Cooperation

Promotion of internal networks and relations to the municipality, interaction with external industries

Networking is a key element to achieve sustainability. There are three main areas where networking takes place. Firstly, inside the industrial area, where the park management initiates a closer cooperation among the companies to enable synergies in doing business together (e.g. obtain contracts at large scale or joint procurement on better terms), in exchanging knowledge on energy and resource efficiency, and in fostering the exchange of services, materials, energy and by-products. Secondly, the park management develops business networks with companies outside the park, upstream and downstream, in order to optimise sales or purchasing conditions. And thirdly, it cares about the participation of the neighbouring community and performs campaigns for a beneficial coexistence.

To do so, the management unit needs to be the networking agent between the entities inside and outside of the industrial area. As networker, it acts pro-actively and brings the stakeholders together to provide information and to exchange knowledge and opinions in a confidential way. If temporary or permanent networks of stakeholders are formed, the park management acts as facilitator, moderator and mediator in case of conflicts.

At the beginning, a sensitisation of all stakeholders for the benefits of networking is required. This will lead to the establishment of more or less formalized network structures with regular meetings within the industrial area, events with external partners and an information platform for the neighbouring community. The management will support these networks actively through interlinking companies (e.g. for industrial symbiosis), establishing close and beneficial interactions with neighbouring industries and joint projects with companies outside the park. Community participation and a good relationship with the neighbourhood is achieved by providing a body for complaints and information and in offering benefits for the local population, e.g. medical service facilities, schools and studying facilities.

Moreover, good networking facilities in an industrial park are a site advantage that can permit resource and financial savings and will attract new investors.

1.5. Participation in Planning and Operation

Stakeholder dialogue, participation of all stakeholders in planning process and during operation

A good planning process is one cornerstone of a sustainable industrial area (cf. 1.1). Ideally, sustainability criteria are included right from the start during master planning and during all following planning steps. Besides considering economic and environmental aspect, social participation within the park and between the park and the local population is crucial.

During master planning, when there are still no companies in the park, participation of the public is important to make sure that the existing different points of view and concerns are considered. This needs adequate possibilities for stakeholder participation throughout the entire framework planning. Helpful issues for stakeholder participation are for example: an agreed park vision, urban infrastructure concepts, business and marketing concepts and measures for mitigating environmental risks.

Once the industrial area has been commissioned, stakeholder involvement, which now include also the residential companies, remains important for all expansions, adaptions and retrofitting measures. In particular the resident companies need to be involved when deciding about the type and industrial sector of new companies to fill existing park vacancies in order to close supply chains or to create symbiosis networks.

As elements of an optimised participatory process the park management should offer public consultation hours, grievance forums on its webpage and make relevant information available to the public to create transparency on all issues.

1.6. Maintenance, Cleaning, Retrofitting

Processes and mechanisms are in place to maintain the industrial area, financing for these services is ensured

In a sustainable industrial area processes have to be developed and mechanisms are put in place to maintain the industrial park, which includes cleaning, infrastructure up-keeping and if necessary modernizing/retrofitting of the infrastructure or its adaptation to changing needs. The cleaning and up-keeping services are usually financed by the companies in the area which pay a respective fee to the management unit. The same applies for large scale retrofitting measures. The exact amount of the fee or contribution is based on one or more criteria (e.g. number square meters/hectares occupied by the company, number of employees or the annual turnover of the company, etc.). Under certain circumstances, governmental funding or co-funding for retrofitting measures to promote certain industries or regions can be eligible as well. Residential companies are obliged to keep their own premises in adequate shape as demanded in the park's charter.

To assure a smooth operation of the industrial area it is fundamental that the management unit monitors the infrastructure permanently. If infrastructure problems are identified they have to be solved cost efficiently and at short notice. This also includes a permanent cleaning and maintenance of common areas. A close contact to the residential companies and pro-active behaviour enables the park management to react promptly on proposals for extension or adaptation of infrastructures. All elements are part of an advanced maintenance and repair concept which ideally would also include strategic decisions to give the park a long-term perspective.

1.7. Disaster Risk Management

Prevention and management of industrial emergencies (e.g. fires, release of hazardous substances); Management of natural risks (e.g. earthquakes, avalanches, storms, floods, landslides)

The management unit of the industrial area needs to take precautions for two types of risks – risks related to the operation of the industrial area and natural risks. Regarding the operation of the area it is the responsibility of the management to implement measures for prevention and management of all emergencies which result from industrial activities (e.g. explosions, fires in chemical processes, adequate and comprehensive transport and storage of dangerous goods, release of hazardous substances). Additionally, the management needs to be prepared for those risks that are not directly related to the operations on site, such as natural disasters (e.g. earthquakes, avalanches, storms, flooding, and landslides). Aspects of climate adaptation and biodiversity conservation have to be considered in this respect as well for mitigation gradually emerging risks.

To build up adequate disaster preparedness the management needs to analyse all potential causes and risks. It would seek the cooperation with the local authorities and connect with the local disaster risk management plans. Based on the risk analysis preventive and mitigation measures are developed together with the companies in the industrial area. This will lead to an overall risk management concept and related disaster plans, which of course have to be monitored and adapted to changes regularly. The findings of the evaluation of natural catastrophes should be already taken into account during the site selection process.

To practically respond to emergencies and disasters a central management and response unit with online-monitoring emergency lines and inter-linkages to respective government institutions has to be in place. This unit coordinates all measures and gives clear advice on duties and responsibilities to the various stakeholders and service units (e.g. fire brigade, medical team, emergency units, etc.). This needs of course qualified staff that is regularly trained for cases of emergency (e.g. simulations, emergency drills) and companies who are advised and assisted to establish their internal safety and emergency systems.

2. Economic and Infrastructure Features

2.1 Economic Viability of Management and Site Management

While an administrative type of park management finds it sufficient if income and costs are in balance, a management company that operates and manages the park entirely on a commercial level intends to generate profits to make the business profitable.

Revenue generation and sustainability of industrial area management

For long-term sustainability the management of the industrial area has to develop a business like behaviour. This requires a business plan, which brings forecasted expenditures and revenues into balance. Revenues are expected from selling and renting the plots, from monthly operating/service fees paid by resident companies and governmental funds for providing housing, education, health or other services to the community. The income has to cover all costs for the management of the park, the provision of services and taxes paid to the government if profits are achieved.

For a park management to become economically successful it is important that the overall park concept is attractive for investors and the business community, that high-level services are offered at reasonable prices and that a lean and efficient management structure minimises the administrative overhead costs. The management requires a customer portfolio and relations management, in order to understand well the demands of the companies. To be cost efficient the management unit may consider outsourcing some or all services to private companies. This needs respective qualified companies and a continuous performance monitoring by the management.

2.2 Fiscal Effects on the Municipality

Direct and indirect costs and revenues, positive economic development, job creation

An industrial site should ideally create positive effects for the municipality or community it is located in as well as for the entire economic region in which it is embedded. Attractive and successful parks are able to influence the regional economic development positively by initiating new supply and product chains and increased economic activities.

Benefits from industrial areas result from tax generation, job creation, general infrastructure improvements, and related education and training facilities. Direct and indirect costs (e.g. infrastructure provision) that are shared with the municipality as well as the revenues (e.g. taxes) should be monitored and made transparent, so that the effects are visible. This supports the acceptance of the industrial area in the neighbouring community and increases the willingness of the local authorities to assist in further developing the area.

For the local population, the creation of new and attractive jobs as well as the provision of housing, education and training, and health facilities is of particular importance. This will increase the attractiveness of an entire region and the wellbeing of the local community.

2.3 Infrastructure Provision and Logistics in General

Park logistics and infrastructure, energy, gas and liquid supply, water and wastewater network, common treatment facilities, communication networks, services for employees

Within the industrial area, infrastructure provision and management is the most obvious role of a park operator. However operators of industrial sites often tend to restrict themselves to the building of roads and the provision of energy and water. However, modern industrial areas have a more holistic approach and take care of all aspects of infrastructure and logistic, supply of energy, water and goods, collection and treatment of effluents and waste as well as provision of communication networks.

A sustainable infrastructure provision is based on a well-designed site master plan, which includes roads capable to accommodate the foreseeable development of traffic as well as bicycle and pedestrian infrastructure, access points and parking areas to manage the stationary traffic. Apart from the general road transport, the entire logistic of goods entering or leaving the area has to be taken care of. This includes the management of entry points like harbours, train terminals, warehouses or other types of logistic hubs, transport facilities like pipelines for gases and liquids, conveyor belts for bulk material and respective storage, loading and pumping facilities. The provision of the communication infrastructure is also part of this service, which includes telephone and internet connections. Green spaces provide for recreational areas for employees, for a better micro-climate and an aesthetic comfort. Finally, it comprises of a common sewage system and effluent treatment plants as well as a system for the collection and treatment of waste.

Apart from production related infrastructure a park needs to provide also services and infrastructure for its employees and residents in the park which includes housing, shopping, education, health, sports and other recreational facilities (cf. 4.1).

2.4 Energy Generation and Distribution

Integrated energy concept comprising electricity grid, gas and steam distribution network, energy efficiency measures and integration of renewable energies

Energy supply and distribution needs to be based on an integrated system of incoming energy from outside the industrial area and energy generation inside the area. The management company has various options to supply energy to its customers at favourable prices. It may buy energy in large quantities from external suppliers or generate energy internally from conventional fuels, renewable energy sources and waste or utilise waste energy, heat and steam coming from the resident companies. This requires of course an integrated electricity, gas and steam distribution network operated by a single entity, ideally the management unit itself.

The selected main source of energy should be the most sustainable option adequate to the region and to the need of the companies of the industrial area with regard to cost-efficiency, constant availability, low-carbon and low in other types of emission. Depending on the agreed park charter renewable energy sources may be given priority. Important elements of such a system are conventional power plants, waste-to-energy plants, renewable energy generation facilities, energy cascading mechanism and a waste heat distribution network. The park management may act as energy service company (ESCo) or contract an external service provider. Trading of CO_2 emission certificates might be an additional task.

Industrial areas intending to become sustainable need to upgrade their standard energy provision system with elements of renewable energy generation, energy efficiency measures and mechanism to reuse waste energy. All measures taken have to be monitored and adjusted regularly to stay in

line with changing framework conditions in the energy market. New environmental or sustainability targets set by public authorities or the park management itself have to be constantly followed up and communicated transparently.

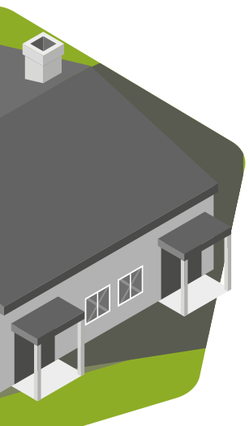
2.5 Waste Management

Waste prevention, handling, treatment, recycling and disposal

Waste management in sustainable industrial areas should follow the principles of the waste management hierarchy which gives avoidance of waste, reuse, recycling and conversion into energy priority to incineration and disposal. In order to set up such a system, the park management needs to offer advice on how to prevent, minimise and separate the waste within the companies. Furthermore it provides joint service facilities at park level for the collection, sorting, treatment, recycling and disposal of the different types of waste including those which are hazardous.

To design an appropriate waste management system the waste flows in the park have to be analysed. For those waste components which are considered valuable ecological and economic sound solutions have to be offered to use these resources inside the park (e.g. within networks of industrial symbiosis or loops of circular economy) or to market them as secondary raw material. The required central waste collection, transport and treatment facilities as well as waste-to-energy plants can be operated by the park management or contracted to private sector companies. The costs for waste handling and treatment are covered by waste fees to be paid by the waste generators. Revenues from recycling may also be transferred back to the waste generators.

A regular monitoring of waste generation and handling in the park is important to secure environmental standards and the goal to minimize waste. This is in particular important if waste management services and facilities are contracted to private companies.



2.6 Water and Wastewater Management

Drinking and process water supply, rain water harvesting, wastewater prevention, treatment, reuse and disposal

The scarce resource water should be attended to a holistic water and wastewater management approach. Responding to the different qualities of drinking and process water needed in the park, the management must be able to offer several water qualities, ideally in a cascading way based on re-use concepts to save water. An analysis of the water distribution system constitutes the basis for identifying the requirements of the industry and existing water saving potentials. Advice and support to reduce water consumption and reuse wastewater is given to companies to raise awareness in the industry. Rainwater harvesting should be practiced on park facilities and the collected water should be made available (after conditioning) to the companies for production purposes (e.g. cleaning, irrigation, cooling).

Similar to solid waste management, measures have to be introduced to prevent wastewater generation and to reuse wastewater (after treatment) as much as possible before disposal options are considered. Due to the different levels of contamination wastewater treatment needs to be accommodated to the releasing industries as well as to the requirements of the companies reusing wastewater. Companies that generate intensively polluted wastewater need to install a pre-treatment facility before they are allowed to discharge their wastewater into the common sewer. Wastewater of the common sewer is treated in common effluent plants.

A good functioning wastewater and surface water system needs clean and proper designed drains. Normally, rain water should be separated from the industrial wastewater. Heavy rainfalls, even in dry regions, can overload the effluent plants and cause problems such as a reduction of degradation or excess costs. In general, all generators in the park need to be connected to the common sewer, although a comprehensive water and wastewater management system which distinguishes between several water qualities for different uses (water cascading) may demand individual closed sub-circuits. A regular monitoring of water qualities and wastewater pollution

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secures that the environmental standards and the customer requirements are met.

The provision of water and the treatment of wastewater is a service which should be offered to the resident companies at cost covering rates. This needs a sound business and operation concept and is part of the overall business plan of the industrial area.

2.7 Transport system

Interlinkage of the park's passenger traffic with the public transport system, efficient and environmental sound transport of goods and passengers inside the industrial area

Inside the industrial area transport of goods and passengers has to be provided. While the transport of goods (apart from bulk materials in pipelines and conveyor belts) is mainly organised by the companies themselves or given to private logistic companies, passenger transport of staff and customers to and inside the area requires the attention of the management unit. Sufficient integration into a public transport system is often not the case.

In order to develop an appropriate transport concept, an analysis of the transport flow (passengers and goods) is a prerequisite. Based on the analysis, an eco-efficient, reliable, economic and environmental friendly transport system needs to be implemented. While access roads to and within the park, sufficient parking spaces and logistic hubs for goods cater for the individual traffic of cars and lories, public buses and metro lines should be introduced to serve the majority of the workers and visitors entering and moving within the park. To assure reliable, safe, comfortable and affordable commuting towards and within the industrial area an efficient passenger transport system is required. It should consider all means of transport (pedestrian, bicycle, scooter, car, bus, tram, metro), but from an ecological point of view it should give priority to public mass transport systems (bus, tram, metro). The public transport can be provided by the local administration, the park itself or contracted to private operators.

If the transport outside and inside the park is operated and organised by different entities it is important to interlink both systems to create a high level of connection quality. This needs an assessment of the existing and expected traffic flows of passengers (and goods) and sufficient transfer and connection points. In an ideal case a transport system should offer high quality transport for passengers (and goods), an affordable fee structure complemented with an eco-efficient transport technology. The design of new industrial parks should minimise distances by route optimization and coordination of transports, e.g. between the residential areas and the work places to reduce the need for transport.

In order to further improve resource efficiency and environmental protection the park management could provide car sharing options, electric vehicles and compressed natural gas buses. The companies on the site should also be encouraged to promote sustainable mobility for their own operations. In general, it should be the aim of any transport concept to interlink the park traffic with its surrounding so that passengers and goods can safely and comfortably enter and exit the park. To permanently upgrade the transport system the experiences made have to be analysed.

3. Environmental Features

3.1. Stewardship for Environmental Laws and Standards

Knowledge about/application of environmental standards, enhanced environmental protection

Environmental protection and high environmental standards are key elements of sustainable industrial areas. Therefore it should be a prominent task of the management unit of the industrial area to help endorse respective laws and regulations and introduce on-site rules. For that purpose, management should provide detailed information about existing environmental laws and environmental standards, both international and national and give advice on their application in the park, e.g. by informing companies in seminars or training staff of the companies. Examples of best practices should be collected and tested regarding their applicability in the park. Rewarding good examples of on-site companies for the most sustainable/environmental-friendly practices help to improve the environmental protection.

Already during the planning phase of an industrial park, it is important to consider and respect all relevant environmental laws. With regard to environmental and climate protection a site suitability assessment has to be carried out. This is normally done as part of an environmental impact analyses (EIA) which is mandatory in many countries for all industrial sites.

To foster the implementation of the applicable environmental standards regarding emissions, water pollution, noise, waste management, biodiversity conservation and climate protection, the management of the industrial area should set a good example and establish relevant management systems for its own facilities and operations (e.g. ISO 14001, ISO 50001). Companies which have been advised on the standards and adopted them should be certified by respective auditing and certifying bodies. Ideally, the defined environmental standards should become compulsory and respected by all companies in the industrial area.

To continuously improve the eco-performance of the park it is necessary to establish an environmental pollution monitoring and reporting system. The park should be given the right to introduce fining measures and to enforce them in case of non-compliance. In this way negative impacts of the industrial park on the environment are minimized and climate change resilience of the park as a whole is increased.

3.2. Promotion of Resource Efficiency and Industrial Symbiosis

Promotion of circular economy and processes of industrial symbiosis, resource efficient infrastructure

It is the task of the management of an industrial area to promote resource efficiency. It should give advice on the topic and support the effort of companies to increase their resource efficiency. In offering training and carrying out company audits possible areas for improvement are identified. Advice on resource efficient technologies and process concepts will enable the companies in the park to increase their resource efficiency. The park management itself should also become a model in providing a resource efficient infrastructure and using their own resource efficient low-energy buildings.

If the possibilities to increase resource efficiency within a company are already exploited, major additional gains can be achieved through networking with other companies in the industrial area and beyond. Depending on the level of inclination of the companies the management can be the spin-doctor for networks for industrial symbiosis and energy efficiency in order to introduce circular economy in the park. For that purpose, the management needs to gather information about the material flows inside the industrial area, identify possibilities of sharing products, by-products, water, waste or energy as well as services or utilities and optimise resource efficiency and the degree of capacity utilisation.

After informing the companies about the economic and environmental benefits of industrial symbiosis projects, the in- and outputs of the companies are analysed and a database is established on park level showing goods, by-products, energy, water and waste which could be exchanged. During network meetings organised by the management unit the companies are encouraged and advised on exchange opportunities. Pilot projects are launched to promote industrial symbiosis and energy efficiency. All information on material flows and experiences gained should be accumulated in a web-based information system to which the park companies should have access to.

Finally, the entire investment and marketing policy of the industrial area should be guided by considerations to promote industrial symbiosis and resource efficiency in attracting relevant sectors or companies who could close supply chains or circular economy loops.

3.3. Monitoring and Control of Emissions

Air emission, noise, light, odour

To maintain and enforce the environmental targets of the park the park management needs to monitor emissions constantly. Besides air borne emissions like partials, aerosols, gases and odour also noise and light are registered. Measurements should take place at individual workplaces (important for occupational health and safety), at emitting sources on company premises (e.g. stacks; verification of allowed emission limits) and open spaces within the park area (measuring the ambient pollution of the industrial area). These measurements are carried out sporadically, in regular intervals or continuously. They can be carried out by the companies themselves, the park management, government authorities or contracted environmental labs.

The obtained data is used to give feedback to companies about their performance and possible violations of legal limits, to report to respective government institution in charge of controlling air pollution and to inform the public in order to reduce stress and discomfort for employees and local residents. In measuring GHG emissions the carbon footprint of the on-site activities of individual companies and the industrial area as a whole can be calculated.

After advising companies on emission standards respective monitoring systems at company level are implemented. As a priority, monitoring should be installed at identified pollution hotspots and ultimately cover all production sites of the area. Emission control at company level should subsequently show positive results at park level. All data is fed into a central remote controlling and recording system which could be interlinked with the respective government institutions.

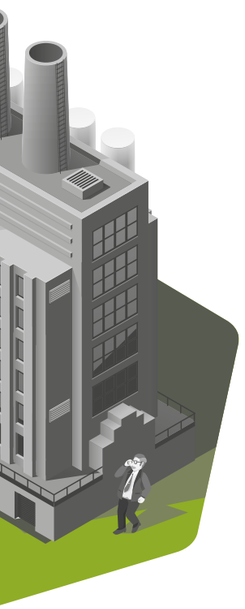
It is the duty of the park management to actively enforce the compliance of emission standards. Being the intermediate institution between the individual companies and the controlling government authorities the park management is able to give feedback to the company at short notice and assist in mitigation measures before major violation of environmental laws take place. If government authorities regard the park management as trustworthy, official government checks can be reduced to a minimum.

3.4. Groundwater and Soil Protection

Prevention of hazards to groundwater and soil, control of surface and groundwater quality

Industrial areas consume land and bear risks of polluting the used land. Pollution of the soil and subsequently the groundwater resources can occur through the leakage of fuel, production liquids or wastewater. Other sources of pollution are dumping of waste or other types of solid residues of production processes. It is the duty of the management unit of the industrial area to monitor the compliance of the companies with the respective laws and in their absence to set compulsory rules for the operations on their site to prevent soil and groundwater pollution.

To be able to identify risks the park management needs to have a clear picture of the production processes in the park and the substances which are used. Companies dealing with substances which are able to severely contaminate soil and groundwater have to present to the park management the measures they take to prevent contamination. It is duty of the management unit to control those companies in regular intervals to verify that the respective measures are in place.



Apart from monitoring and controlling individual companies the park should regularly monitor the surface and groundwater quality downstream of the park to identify occurring pollution and possible sources of contamination. All pipelines and drains are regularly checked to prevent that liquids are leaking into the ground. This is also necessary for the underground sewer system which has to be examined on a regular basis. In case soil and groundwater pollution is detected, the park management coordinates and supervises effective measures to minimize the impact and to decontaminate the soil.

3.5. Promotion of Biodiversity

Provision of habitat, biodiversity management plan, measures or promotion of biodiversity on the site

As the economic performance of businesses depends on functioning ecosystem services, for instance regarding water supply for the production process and fresh air for employees' health and productivity, aspects of biodiversity should be a central feature of site master planning as well as of the park's code of conduct. In doing so, functioning ecosystems and biodiversity will be preserved while business risks, for instance with regard to climate change impacts, like water shortages and heat waves, will be mitigated.

During the planning phase of a sustainable industrial area, the park management considers biodiversity concerns (cf. 1.1) and develops a biodiversity management plan. The park management identifies the distribution and different functions of local habitats and defines the right mix of production, recreational and natural areas. As a further service provision, the park management assesses the resident companies' impacts on biodiversity and their dependencies on ecosystem services in detail. By looking at the companies' production cycles, the park management determines measures to avoid or minimize negative effects on biodiversity, for instance by making use of symbiosis networks and circular economy approaches, by restoring degraded ecosystems (e.g. planting of trees) or by establishing buffer zones. In case the scope for mitigating harm on biodiversity is limited while the biodiversity losses caused by certain companies are significant, the park management identifies other solutions. These can include biodiversity off-setting or compensation measures, for instance payments for the protection of species or ecosystem services.

During operation it is the task of the management unit to supervise resident companies whether they respect regulations at local, national and international scale. If national regulations fail or do not go far enough, the park management will adopt the protection of biodiversity as voluntary duty and can even – as a pioneer for linking biodiversity and business issues – advocate for better regulation within the political sphere.

Furthermore, the park management monitors the implementation of biodiversity measures, also with regard to their implications for the park's economic performance, along with other environmental indicators (cf. 3.3, 3.4 etc.). The results can feed into CSR reports and allow for a constant improvement of the measures' design.

Overall, the park's biodiversity management plan does not serve as a detached strategy document; it is rather integrated into the general development plan of the sustainable industrial area. Hence, the park management takes a holistic approach on biodiversity conservation that creates a twofold win-win setting: a net gain of biodiversity and a better economic performance of the on-site companies given by lower operating costs, a supportive environment of stakeholders, compliance to regulatory requirements and a higher reputation in general.

3.6. Efficient Land Use

Building/land use coefficient, green and open spaces, area integration

During master planning of new industrial areas concepts for efficient land use have to be developed. These concepts take the existing local land use planning into account and make use of the provided space in a sensible manner - in particular in reducing the levelling of the land. If a local land use planning does not exist, other strategic government documents and the already existing infrastructure have to be taken into account.

When developing a land use concept the relation between buildings and green open spaces is important. It has to be guaranteed that land is used efficiently and contiguous space for the improvement of microclimate, the protection of biodiversity and the recreation of people working onsite is reserved as well. This needs the introduction of certain regulation and building codes such as maximum building heights, land use coefficients and surface area relations.

During retrofitting of existing industrial areas, which are often too densely packed with buildings and production sites, possibilities have to be investigated to introduce additional open spaces and green lands. This may mean to relocate production sites or to renaturalise abundant plots. At the same time the allocation of new green fields should be avoided.

3.7. Climate Change Mitigation and Adaptation

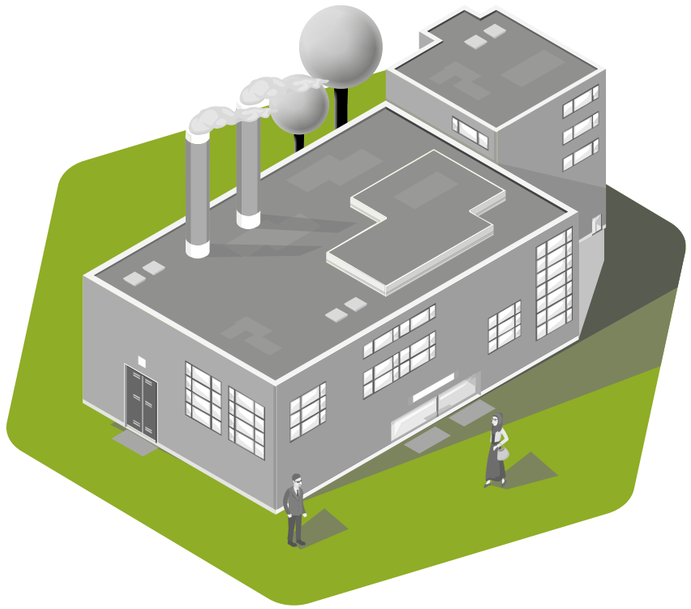
Joint emission reduction measures / adaptation to climate change: capacity development, climate resilient planning

To achieve sustainability of industrial parks the issues of climate change mitigation and adaptation can no longer be neglected. While the reduction of greenhouse gases goes in line with measures to increase energy and resource efficiency, adaptation is required to maintain long term operability under changing climate conditions.

To mitigate climate change measures to reduce the emission of greenhouse gases have to be introduced. For that purpose the management unit approaches the companies on site to develop a strategy to reduce greenhouse gas emissions. Typically emissions derive from energy provision, operation of industries, transport of goods and people, waste generation and treatment. After assessing the status quo of emissions, measures should be developed introducing best available technologies. Decision makers need to be informed about available technical and financing options.

For the adaptation to climate change, capacity development is required to introduce climate resilient planning and policy development. Such planning takes into account the adverse effects of climate change, like shrinking water resources and extreme weather conditions which could result in environmental disasters. The possible consequences of climate change should therefore be incorporated into the risk management plans of companies and the entire park. Based on a risk analysis, sensitisation and capacity development needs to take place to mainstream awareness on all levels and to actively consider adaptation measures in the site selection, planning and implementation of new parks as well as in retrofitting of existing industrial areas.

To introduce the issue of climate change mitigation and adaptation the park management should initiate a survey of the various activities, the amount of greenhouse gases emitted and major contributors to climate change in the industrial area. As a next step, it is important to create awareness among the companies regarding their responsibility and motivate them to take action. The contributions at park and company level should flow into a comprehensive concept for climate change mitigation and adaptation. This should include financing options and the monitoring of identified key projects.



4. Social Features

4.1. Social Infrastructure

Education, culture, leisure, local supply, common catering, medical services

Social infrastructure addresses different aspects to improve the living and working conditions of the employees of the area, as well as of the neighbouring communities. The needs of the employees might vary substantially depending on the industry sector and the country. It makes also a difference if employees commute every day into the industrial area or live inside it. While some sites are pure industrial areas, others have to be regarded as communal development zones with a wide spectrum of facilities and activities.

Basic social infrastructure should cover catering, small shops or kiosks and communication facilities. Especially for risky work conditions adequate medical services are necessary. Educational and training institutions specialised to train apprentices and employees of the industry sectors settled in the park are very important and may be one key success factor. If many workers live with their families close to or on the premises of the park, the question of schools for children needs to be addressed. Adequate child care facilities are required. If the park is regarded a development zone the basic facilities needs to be complemented by further shopping and banking facilities as well as recreational and sports facilities. In providing a cultural infrastructure (e.g. cinema, cultural events and congregation space) the areas can play an important societal role.

To develop a social infrastructure concept for an existing park the present status has to be investigated, shortcomings identified and a plan to improve the situation needs to be elaborated. This should be based on a needs-assessment carried out among the employees or users of the park (simple interviews/questionnaires). The assessment should try to reach all types of target groups since their particular needs may vary much from each other (e.g. trucker vs. female manager). Based on the understanding of the present situation and the needs and expectations of the people in the park, the social infrastructure concept is implemented. During implementation the feedback from the users should be monitored regularly to ensure that the concept meets their expectations.

4.2. Promotion of Lodging Standards

Standards for housing of employees within or close to the industrial area

For large industrial areas and in particular for mixed-use zones the provision of sufficient accommodation for workers and employees within or close to the industrial area should be considered. This reduces the needs for transport (energy and costs savings) and shortens the travelling time of workers to their workplace (improved work-life balance). Some production sites also require large seasonal work forces which typically do not have permanent houses in the vicinity. Moreover diverging accommodation needs for truck drivers, visitors and other clients need to be considered. To guarantee that lodging facilities are acceptable respective housing standards have to be defined which should be monitored by the park management.

Due to the various types of jobs, incomes and living standards of employees in an industrial area the expectations regarding lodging and housing vary considerably. To meet the needs of the various groups it will be necessary to conduct some survey or analysis. Depending on the results different types of houses and lodging facilities have to be provided in collaboration with the residential companies and the local administration. Existing industrial areas may develop their housing concept based on the analysis of existing shortfalls and the need to consider the restrictions of space. New industrial areas should ideally integrate the provision of affordable, decent housing facilities already in the park development concept mixing housing, shopping and recreational areas in a balanced manner.

4.3. Security Concept

Security service, access control, enhanced safety for women, camera surveillance

A security concept is crucial for both the personal security of the employees and the security of the companies against burglary. In a closed industrial area security can be achieved in limiting the access points of the park which are constantly under surveillance. Within the park good lighting, camera surveillance, emergency phones and patrolling security personnel are key elements to enhance security. Apart from general security aspects ladies safety has to be dealt with priority.

In more open development zones, security of production sites is primarily in the hands of the companies themselves which control their own company access points and premises. In this case, it is the duty of the park management to provide security at public spaces inside the development zone. Camera surveillance, patrolling security personal and a police station or central unit in charge of the security within the area should be available to give assistance to employees and residents in need.

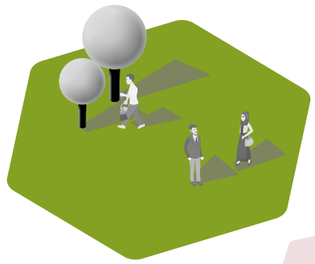
In an ideal case the security concept of a park should be designed in a way that the employees can come and leave work at any time without being afraid of insecurity. Special attention should be paid to higher security needs of women. If travelling outside of the park during night is not safe, possibility to stay overnight, in particular for female employees, should be made available.

4.4. Promotion of Working and Occupational Health Standards

Workplace comfort, e.g. air quality, visual comfort, noise protection

The promotion of working and occupational health standards in the industrial area addresses health and safety at the workplace itself. It comprises aspects such as workplace comfort regarding air quality, visual comfort, noise protection and an appropriate work-rest balance. Regular medical check-ups of workers and employees, provision of safety gear (protective google, glows, safety shoes, filter masks, etc.), monitoring of exposure limits and safety trainings are important measures to increase occupational health and safety.

While it is primarily the duty of the companies to secure occupational health and safety on their plants, the park management needs to carry out awareness creation measures and should offer information, sensitisation and training of specialised officers in the companies. A baseline study of the existing working and occupational health situation in the resident companies may be used to develop respective information and training material in order to achieve a common level.
It should be an overall goal to develop binding working and occupational health standards for all companies of the industrial area. These standards should be part of the park's code of conduct and should be monitored regularly and enforced by the management unit.



4.5. Promotion of Gender Equality

Addressing differentiated needs of men and women; Promoting women's entrepreneurship

In many countries women are still underprivileged. Although they often represent a large part of the workforce of an industrial area, the parks do not care sufficiently about the specific needs of women. Ignorance exists for example regarding their needs for separate toilets and washing facilities, their various roles as worker, housewife and mother, their vulnerability in respect to security or their different requirements as business women or entrepreneurs.

Therefore, the park management should investigate the needs of women and consider them in all steps of planning, implementation and operation. This demands an intensive dialogue with representatives of female workers and entrepreneurs.

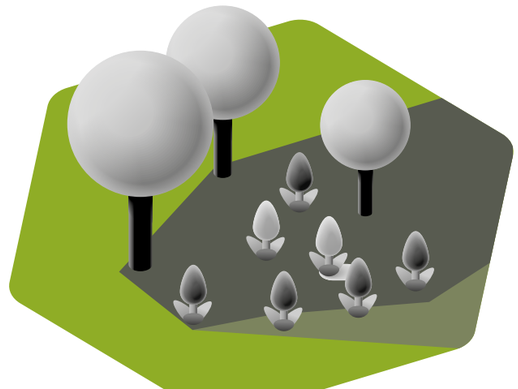
Apart from improving the situation of women in respect to security, transport needs, family support and occupational health and safety, a sustainable industrial area should also look into promoting women's entrepreneurship. The management could offer business trainings for women to support their management skills. Such trainings could be directed to micro and small enterprises as well as to women in the management of larger firms. Business opportunities as part of the infrastructure of the industrial area (e.g. kiosks, canteens, recycling) could preferably be given to women or a respective quota could guarantee a female share. The staffing of committees or boards in the industrial area could also be guided by a quota for women securing their representation and improving the groups' work. Women entrepreneurs may also be promoted by offering women's clubs and meeting opportunities. These efforts may also lead to reserved areas in a park or the creation of complete industrial areas only for women entrepreneurs (e.g. ALEAP, India).

4.6. Encouragement of Trade Unions and NGOs

Open policy, non-discrimination

Transparency is an important attribute of a sustainable industrial area. It includes not only the information of everybody inside and outside of the park regarding the future development or possible environmental risks but also intends to promote civil society and the activities of its institutions in the industrial area. While trade unions in particular take care of the workers' rights and are an important factor for better working conditions, NGOs and other civil society organizations will address more general environmental, social and even political issues.

Ideally, the management of the park maintains a regular exchange and constructive dialogue with trade unions and important NGOs. It acts as mediator between the different parties and secures non-discrimination in the park. In this way, the park management encourages and facilitates the dialogue between employers and employees and enhances the general dialogue with the public. Although temporary conflicts have to be expected, at an overall perspective transparency and participation of the civil society maintains the long term acceptance of the industrial area.



Published by:
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