

Greening TVET

Colleges Initiative in South Africa

From individual competence development
to institutional change



A guide for practitioners

Editor

Skills for Green Jobs (S4GJ)

Deutsche Gesellschaft für Internationale
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Registered offices: Bonn and Eschborn

GIZ Office Pretoria

P.O. Box 13732, Hatfield 0028

Hatfield Gardens, Block C, 2nd Floor,

333 Grosvenor Street

Pretoria, South Africa

Tel.: +27 (0) 12 423 5900

E-mail: giz-suedafrika@giz.de

www.giz.de

Responsible: Edda Grunwald

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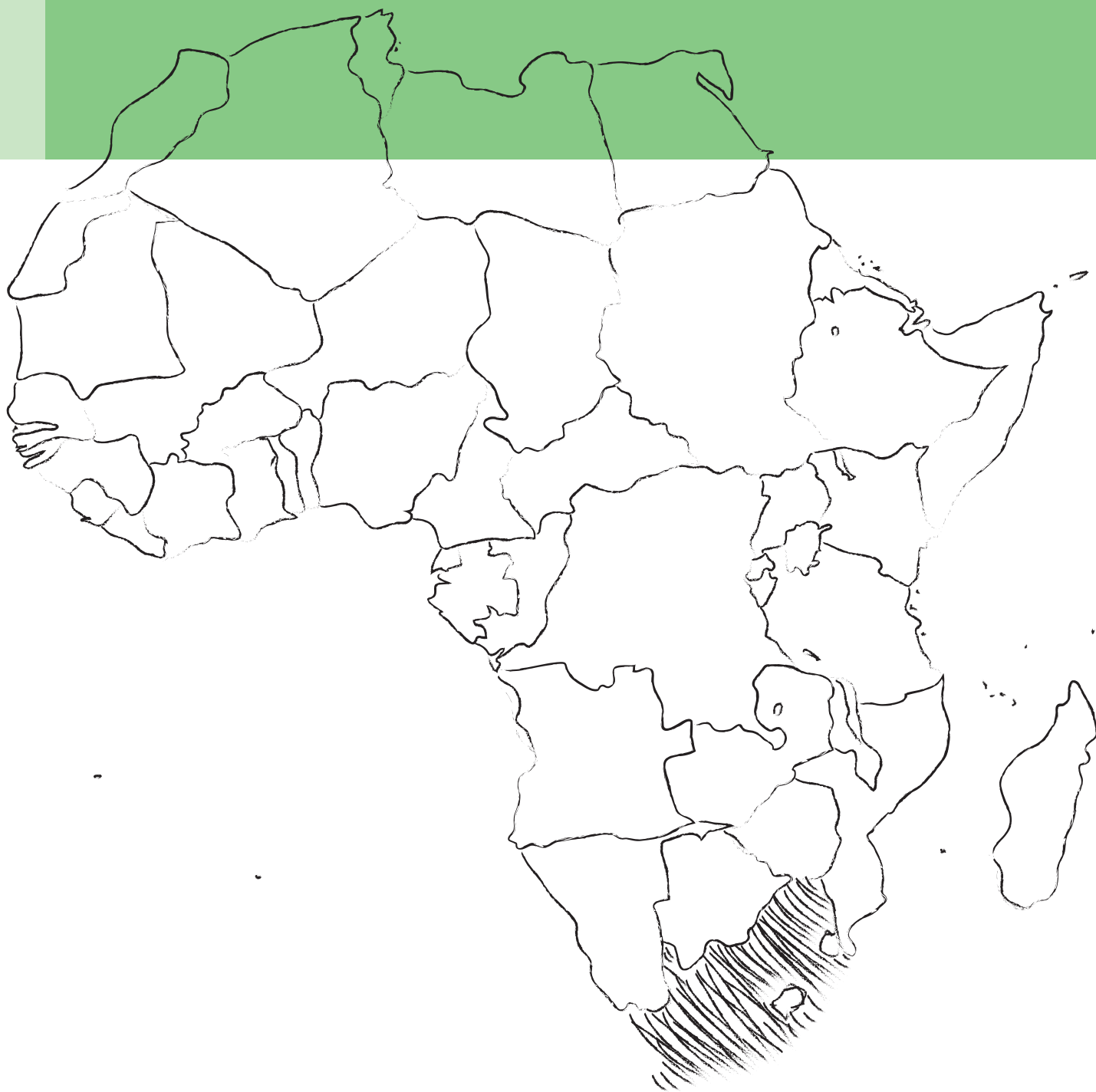
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Foreword | DHET

The Department of Higher Education and Training is pleased to be part of the Greening of Technical and Vocational Education and Training (TVET) colleges' initiative in South Africa.

The "Greening of Colleges" initiative, which aims to establish colleges as green environments is based on international best practices in the greening of colleges was launched early in May 2013 and currently involves seven colleges in the pilot phase.

The seven colleges participating in the project are:

- Boland TVET College
- Central Johannesburg TVET College
- Eastcape Midlands TVET College
- Northlink TVET College
- Northern Cape Rural TVET College
- Port Elizabeth TVET College
- Umfolozi TVET College

In this context, the 'Greening of Colleges' initiative focuses on the development of special green profiles and the integration of green issues in selected TVET colleges. Green TVET colleges are critical as it integrates green issues into training programmes, college policies and plans. Ideally, they live what we preach by reducing the carbon footprint on their campuses. They also integrate their internal, and as far as possible external stakeholders in the greening process through train-the-trainer programme for companies and supporting communities in improving their living conditions through green projects. In addition the greening colleges do not stand alone but are connected with other colleges in national and international networks.

South Africa's future energy supply will need to have lower greenhouse gas emissions in order to meet the challenges posed by climate change. The need for informed and trained human resources in this field continues to be a significant driver in future employment. The Industrial Development Corporation and South African Development Bank in 2011 estimated that the total employment potential of the green economy would be over 450 000 direct jobs over the long term until 2030, whilst the projections under the category for energy generation, and energy and resource efficiency for the long term would be 130 000 and 68 000 respectively.

This initiative serves as a vital purpose in harnessing the skills development efforts of the Department. South Africa lags significantly behind in promulgating policy that coerces or compels 'green behaviour' in ordinary citizenry. Until there is a massive national mind shift towards caring for the environment, all other initiatives are likely to be driven by business imperatives alone which are undesirable. The nation's psyche has to be shaped in a way that makes environmental protection and preservation a norm rather than a special intervention. There is no better place to begin than with the thousands of young people in our institutions who have massive footprints into local communities and regions, and are able to spread the attitudes, knowledge and values around greening behaviours.



Mr GF Qonde

Director-General: Higher Education and Training



environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

Preface | DEA

The Environmental Sector Skills Plan (ESSP, DEA, 2010) released by the Department of Environmental Affairs describes the status quo with regard to the demand and supply of environmental skills and provides the best available information on scarce and critical skills in the sector at present. Furthermore, the ESSP identified skills gaps in environment management, environmental science and environmental education sectors in South Africa.

Today we face challenging choices on how best to invest skills for current and future generations, grow a collective desire to create a society living in harmony with the environment and revolutionising how buildings and neighbourhoods are envisioned, built and operated. However, as we move towards the sustainable future we want, environmental responsibility should be our call for action. Given the ascribed role of Universities and Further Education and Training (FET) Colleges in society, and the prevailing environmental and sustainability challenges, they are both coming under increasing pressure to engage with and respond to climate change and other sustainable development issues like energy and water and the associated risks and opportunities.

On the 23 April 2012, the Department of Higher Education and Training, as well as the Department of Environmental Affairs supported the launch of the Green Campus Initiative. As a vital part of a country's growth, it only makes sense that Further Education and Training (FET) (now called the Technical, Vocational Education and Training (TVET) Colleges and Universities) should play a key role in ensuring the sustainability of important resources. Though the concept of sustainability has only recently entered the public psyche, a handful of Universities and FET (TVET) Colleges have had sustainability on their mind for decades. Campus "greening" initiatives are catching on at FET (TVET) Colleges and Universities across South Africa to help define and also to become exemplars of environmental best practice.

Your campus has to take the first steps towards environmental responsibility by looking at the physical dynamics that directly and indirectly affect the environment. By taking this initiative, you are sending a clear message that through self-study, you can educate yourselves, empower others and discover solutions that will ensure a sustainable future. All this is achievable through comprehensive sustainability plans that integrate curriculum, research initiatives, community and student engagement.

It should be noted that the success of a green campus is dependent on development of institutional capabilities and skills, including an integrated approach to planning and implementing sustainability initiatives. Therefore, it is necessary to engage all stakeholders like administrators, facilities staff, faculty students and the surrounding community to create a green campus.

This Manual is part of a wider greening initiative established by the Department of Environmental Affairs and we would want to encourage participation of all FET (TVET) stakeholders to consider environmental and sustainability aspects of a Green Campus Initiative.

In conclusion, it is important to emphasise that this is a living document. Continual qualitative improvement, as distinct from unlimited quantitative growth, is the essence of sustainable development. So we welcome your feedback, examples and case studies for inclusion in the manual, and to update future editions of the published version.

For more information, please contact:

Mr Thomas Mathiba

Director: Sector Education, Training and Development

The Department of Environmental Affairs

Tel: (012) 399 9922

Email: tmathiba@environment.gov.za

Foreword | GIZ-S4GJ

Climate change and environmental degradation is a consequence of unsustainable business and consumption patterns but, albeit presenting severe global and local challenges, it also provides for new prospects for economic activity that were not previously pursued. Through promotion of a green economy, South Africa has unique opportunities to create substantial numbers of new jobs and address the concerns about climate change, and environmental and social challenges at the same time. This however, requires a mindset change within South Africa and with it the development of appropriate skill sets. On behalf of the German Ministry of Economic Cooperation and Development (BMZ) and in context with the Skills for Green Jobs (S4GJ) programme, jointly developed and implemented by the South African Departments of Higher Education and Training (DHET) and Science and Technology (DST), a number of activities aim to:

1. Support qualified TVET lecturers in their continuous professional development through training in renewable energy & energy efficiency technologies;
2. Develop a new optional vocational subject on renewable energy & energy efficiency technologies for NC(V) students; and
3. Initiate various greening of TVET college activities as essential awareness raising and cross-cutting themes for sustainable development.

These activities are currently taking place in 11 TVET colleges in five provinces and seek to introduce NC(V) students to future technologies and preparing them to enter the labour market, seizing the opportunities green industrial development could offer. Thus, it is important for TVET students to develop green mindsets and strong capacities for technologies, as these sectors are expected to create a large number of green jobs within the next decade. In this context, the initiative "Greening of Colleges" focuses on the development of special green profiles and the integration of green issues in selected TVET colleges. These colleges should become role models for environmental friendliness, as well as a source of inspiration and an innovative and profound training provider and accepted strategic partner for sustainable development of their region. Green TVET colleges have a special profile and integrate green issues in training. Ideally, they live what they preach and try to reduce the carbon footprint on their campuses. They integrate their internal and – as far as possible – external stakeholders in the greening process, train their trainers, provide further training for companies and improve the living conditions of their communities by means of green projects etc. Greening colleges don't stand alone but are connected with other colleges in national and international networks.

Subsequently, we are very happy that the practitioners guide "Greening TVET Colleges Initiative in South Africa: From individual competence development to institutional change" is now available. The initiative is not restricted to colleges – it can easily also be implemented in schools and universities. We hope that the present guide will inspire and motivate more educational institutions to join the initiative and allow already participating colleges to implement further activities.

Yours in greening ...

The GIZ-S4GJ team!

1

ROLE AND TASKS OF TVET COLLEGES IN THE CONTEXT OF A GREENING ECONOMY



1.1 Need for greening the economy

In the 21st century there are a lot of global challenges to meet: The growth of population makes it difficult to fight hunger which is still a huge challenge to be tackled in parts of the world. The worldwide consumption of fossil fuels for energy production and the emission of CO₂ and other greenhouse gases involved is increasing. Climate change and its direct and indirect impact will change the living conditions all over the world dramatically. The oceans, forests and other relevant ecosystems are under pressure and there is a rapid loss of biodiversity. It is long since clear: Humankind is demanding much more resources and services than the planet can provide.

Technological approaches alone are unsuitable when meeting these challenges; instead a new social and economic approach is required. At the United Nations (UN) Conference for the Environment and Development, held in Rio de Janeiro, Brazil, in 1992, the international community agreed on sustainable development to be the global guiding principle for action. According to the definition of the UN World Commission on Environment and Development (WCED 1987), a development is sustainable, if it “meets the needs of the present without compromising the ability of future generations to

meet their own needs”. The key concept of sustainable development is to keep the world in balance. The key thought is that, in the long run, we cannot live at the expense of people in other regions of the world or at the expense of future generations. The environment, economy and society mutually affect each other. There will be no long term economic or social progress without a healthy and intact environment. At the same time, it will not be possible to protect the environment efficiently, if people have to fight for their economic livelihoods.

Within the overall concept of sustainable development the concept of a green economy has established itself on a global level as the new environmental guiding principle. It refers to an economy that is oriented towards ecological sustainability, economic profitability and social inclusion. The United Nations Environmental Programme (UNEP) defines green economy as an economy which “results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. In its simplest expression, a green economy can be thought of as one which is low-carbon, resource-efficient and socially inclusive. Practically speaking, a green economy is one whose growth in income and employment is

driven by public and private investments that reduce carbon emissions and pollution, enhances energy and resource efficiency, and prevents the loss of biodiversity and ecosystem services” (UNEP 2011, 19).

According to the United Nations Industrial Development Organization (UNIDO 2011, 16) the green economy approach contains a two-pronged endeavour:

- Greening of industries – ensuring that all industries, regardless of sector, size or location, continuously improve their environmental performance through using resources more efficiently, phasing out toxic substances, substituting fossil fuels with renewable energy sources, improving occupational health and safety, taking increased producer responsibility and reducing the overall risks.
- Creating green industries – stimulating the development and creation of industries that provide environmental goods and services. This sector covers all types of services and technologies aimed at contributing to reducing negative environmental impacts or addressing the consequences of various forms of pollution. This includes material recovery, recycling companies, as well as companies that transport, manage and treat waste. Further examples are engineering companies that specialise in wastewater treatment, air pollution control and waste treatment equipment. The sector also encompasses environmental and energy consultants, as well as providers of integrated solutions, for example, energy service companies that offer design, implementation of energy saving projects, energy conservation, energy infrastructure outsourcing, power generation, energy supply, and risk management. Another segment is monitoring, measuring and analysis providers. Green industries also include companies that manufacture and install renewable energy equipment and companies that develop and produce clean technologies.

The transformation to a green economy - which also means a social transformation of lifestyles, habits and behaviour - is a big challenge, but also a

big chance. Different countries face different challenges. However, in general the following opportunities are seen:

- Investments in ecological change are able to stimulate the development of technologies and innovation.
- Optimising energy and resource efficiency leads to significantly improved competitiveness of enterprises.
- Jobs of many existing workers (for example, plumbers, electricians, metal workers and construction workers) will simply be redefined as day-to-day skill sets, work methods and profiles are greened.
- By introducing new (greener) production procedures, as well as by producing environmentally friendly products, new jobs can be created.
- Some employment will be substituted—as in shifting from fossil fuels to renewable energy, or from landfill and waste incineration to recycling.
- Certain jobs in economic sectors that are less environmentally friendly may be eliminated without direct replacement.

On balance, UNEP is convinced that the greening of economies has the potential to be a new engine of growth, a net generator of decent jobs and a vital strategy to eliminate persistent poverty. So a transition to a green economy has the potential to benefit all: the environment and climate, economy and employment markets, as well as every citizen.

As yet there has been no consistent definition of green jobs and how they are different from conventional jobs. UNEP (2008, 35f.) defines green jobs as “positions in agriculture, manufacturing, construction, installation, maintenance as well as scientific and technical, administrative and service-related activities, which contribute substantially to preserving or restoring environmental quality”. ILO considers a green job as one that helps to reduce a negative environmental impact and contributes to environmental, economic and social sustainability of enterprises and economic sectors while also meeting the criteria for decent work, viz. adequate wages, safe conditions, workers’ rights, social dialogue and social protection (see ILO/CEDEFOP 2011, 4).

In practice it is not that easy to distinguish a so-called “green economy” from conventional economic sectors. This quickly becomes clear when looking at the various economic sectors and their close relationship all along the value chain. To assess a company or an economic sector to be green or not, an entire production chain has to be considered. Green products such as wind turbines, solar panels, biofuels, electric vehicles, sewage plants or waste treatment plants are not necessarily manufactured according to cleaner production concepts; the companies within the production chains do not necessarily respect human rights or offer adequate working

conditions. Additionally, the manufacturers of green products use preliminary and intermediary products like generators, poles (for wind converters), electric engines, and measurement and control technologies etc. which are not necessarily labelled as green. On the contrary, they can compete with food production (like biomass plants) and they can cause ecological damages like the farming of biomass plants (corn, palms etc.) in monocultures. Therefore, it is not enough to look just at the final product but also at the production chain. This is the main reason why it is so difficult to identify specific green jobs with the specific green skills required.

In this guide the term “green” is used to highlight specific economic sectors which as a whole are highly relevant for nature reserve, environmental protection and climate protection such as renewable energy, sustainable forestry, green construction, organic agriculture, water supply, waste water treatment and waste management. Unlike this the term “greening” is used if the focus is on the process of transforming economic sectors to become more sustainable and environmentally friendly. Improvement of environmental performance, reduction of emissions, avoidance of waste, energy and resource efficiency are some of the main topics of “greening”.

South Africa has embarked on a major policy drive to invest in a green economy. The green economy has the potential to be a new engine of growth, a net generator of decent jobs and a vital strategy to reduce poverty. South Africa’s New Growth Path of 2010 identifies the green economy as one of the key sectors for employment creation with the potential for creating at least 300,000 additional direct jobs by 2020. New green jobs are particularly expected in the fields of natural resource management, waste management, green energy generation and energy and resource efficiency as well as emission and pollution mitigation. Besides this a wide range of economic sectors and therewith a lot of jobs will become affected by processes of greening the whole economy in terms of efficient use of energy and other resources, avoiding waste and pollution, etc. TVET is demanded to educate and train people to meet the new skills requirements arising in both the green economy as well as economic sectors which are greening.

1.2 TVET – master key for a green(ing) economy

The importance of developing human resources for sustainable development through technical and vocational education and training is undisputed. TVET should equip people with the knowledge, competencies, skills, values and attitudes to become productive and responsible citizens who appreciate the dignity of work and contribute to sustainable societies (see UNESCO-UNEVOC 2004, p. 1). Beside technical skills, raising awareness and a change of mindset are needed. Transforming the economy and society in line with the concept of sustainable development is only possible if people embrace the inherent values and attitudes of this idea, and if people possess the needed skills and are able to apply them in practice. This makes clear that integrating sustainability into the skills development sector cannot be reduced to individual vocational subjects or occupations. The challenge for TVET, then, is to re-orientate and re-direct its curricula with respect to the conservation and sustainable use of resources, social equity and appropriate development, and additionally with the competencies to implement sustainable practices at the workplaces.

Both requirements of green jobs as well as the greening of jobs are the results of technological and economic changes in industry. Meeting these requirements in vocational education and training courses is not a new, but a common business for the skills development sector. New are the skills requirements which come up in this context:

- Employees have to understand the environmental impact of their occupations / jobs.
- They have to know how they can contribute to a clean environment and avoid environmental risks and damages at their workplaces (e.g. by handling hazardous substances correctly).
- They need the knowledge and skills to use energy and resources efficiently, how they can avoid waste, re-use or recycle materials.

- A change of mindset is needed. The ability and willingness to take on producer's responsibility for the results of one's work is central – all of course within the employment's limits.

These are skills relevant for the whole workforce and should be trained in every occupation and training course.

Additionally in some occupations / jobs / industries and complementary to already acquired skills, special technical skills are needed, e.g. to install solar systems, to maintain wind turbines or to operate a wastewater treatment plant. Even these “green” skills are just special technical skills which in principle cannot be distinguished from conventional technical skills. The application is just different.

The contribution of TVET to a sustainable development

Vision: A skilled and capable workforce that contributes to and benefits from a growing greening economy towards a sustainable development of our planet.

Mission: To provide adequate skills development which meets the requirements of a greening economy, and contributes to achieving the national and international targets of sustainable development and climate protection.

1.3 Greening TVET institutions

Skills development is the master key for an economic and social transition towards sustainable development. Sustainable development requires a new mindset, a green transformation of the economy, and occupational as well as cross-occupational skills adequate to support the transformation process. TVET institutions, especially TVET Colleges, are of vital importance to prepare the workforce to be able to meet the skills requirements of a greening economy.

Since all generations of trainees / students spent a certain time of their lives in a TVET institution, there is a good chance to reach many people and to train them to become ambassadors of the greening process and to use and pass on their green skills in business and private life. It is not sufficient just to train technical skills, one must raise awareness

and support a change of mindset – both with the instructors and the students – TVET institutions have to become green, too.

According to the greening colleges approach which goes back to a proposal of Mr S. Majumdar (2010), these green colleges become role models for environmental friendliness, as well as a source of inspiration, an innovative and profound training provider and accepted strategic partners for sustainable development of their region. Greening colleges have a special profile and integrate green issues in training. They live what they preach and try to reduce the carbon footprint of their campuses. They integrate their internal and – as far as possible – external stakeholders in the greening process, train their trainers, provide further training for companies and improve the living conditions of their communities by means of green projects, informal training, technical support etc. Greening colleges don't stand alone but are connected with other colleges in national and international networks.

Greening is much more than just a new topic which could be left to committed individual teachers or executed in single projects additionally to the “real” subjects. A greening of TVET institutions cannot be achieved by piecemeal or ad hoc approaches. Instead, a holistic framework is need-

ed to transform TVET institutions in a comprehensive manner to support a green society and green economy.

Human Capacity Development is corresponding to this holistic framework, as individual competence development is always focused on institutional change processes in the frame of a given work envi-

ronment of the individuals.

Why did the colleges participate in the Greening Colleges Initiative?

Boland College is participating in the Greening Colleges Initiative because the college seeks to develop an ethos of environmental responsibility in all its staff and students as well as in the management of its assets.

Mr Kabedi Mpopote, Boland College

At Central Johannesburg College the concept was initiated by the College principal between 2007 and 2008 when the country was experiencing the shortage of electricity, based on the Government call to save and conserve electricity. The principal outlined his vision for greening the college, and he expected all members to cascade it to respective campuses and sites. He also edged each campus and site to organise a stakeholder grouping or committee that will take the initiative further.

Ms Gloria Tshabalala, Central Johannesburg College

At Eastcape Midlands College we want to minimise our carbon footprint and reduce overhead cost with the introduction of solar and wind energy.

Mr Ziyaad Smith, Eastcape Midlands College

Green building on campuses is purposeful construction that decreases resource usage for the future. At Northern Cape Rural FET College we see the short and long term economic benefits. Students at campuses where greening initiatives are being used will benefit by increasing their potential to gain knowledge. This will afford the opportunity to see the campus as environmentally sustainable. Also this will make students aware of the issues the earth faces with carbon emissions and increased consumption.

Ms Raquel Marinus, Northern Cape Rural FET College

The entire college management agreed that we, the Northlink College, as a collective commence with projects that would enhance the longevity of our planet by waste management initiatives energy savings programmes, resource management, etc to address all of the pillars on which this initiative is based. Everyone seemed very eager to get this off the ground and the Belhar Campus has been earmarked to spearhead the whole process.

Mr Terence Slade, Northlink College

Umfolozi College is situated in the heart of the community in KwaZulu Natal which forms part of a wetland. We would like to teach students about the importance of energy conservation and about wise use of natural resources. Our intention is for students to take this message of conserving natural resources back into the community.

Ms Sheritha Singh, Umfolozi College

2

THE GREENING TVET INSTITUTIONS APPROACH



2.1 Overview

Based on a profound TVET performance that meets the skills requirements of the labour market, Green TVET institutions follow a holistic framework that is built upon five dimensions to anchor sustainable development principles in TVET institutions:

- **Green Campus:** Permanently reducing the carbon footprint of students, teachers and staff within the TVET institutions.
- **Green Curriculum:** Meeting upcoming skills for green(er) jobs by integrating green issues in already existing curricula and/or providing new green training programmes and projects.
- **Green Research:** Fostering the development of a research culture in relevant areas not necessarily on an academic level but as a teaching and learning approach.
- **Green Community:** Extending sustainable development practices at community level by

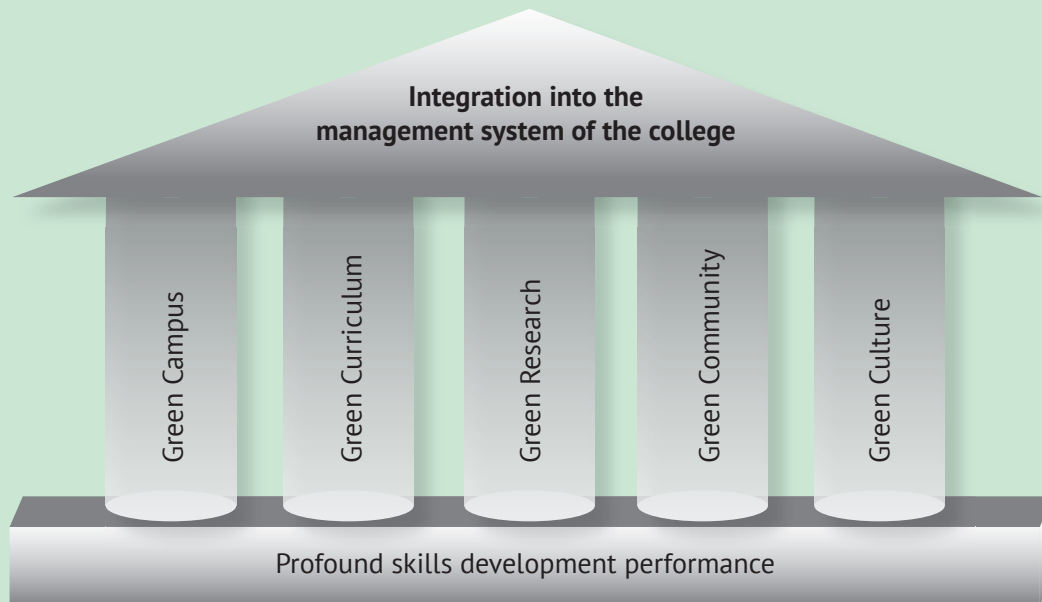
transferring knowledge to the community, as well as from bringing in experiences and questions from private life to school.

- **Green Culture:** Strengthening green values, ethical standards, attitudes and practices - because without values, without ethics, without the changing of our lifestyle nothing will happen.

Additionally to the original approach, another element is included into the Greening TVET institutions approach:

- **Embedding of greening activities in the management system of the institution:** Following a systematic approach (executing an environmental review, identifying relevant aims and activities, implementing, monitoring, fixing results and updating measures) coordinated with or integrated into the corporate management system.

The greening TVET institutions concept



2.2 Principles of greening TVET institutions

Greening TVET institutions requires extensive organisational development (OD) and human resources development (HRD) processes in which the principles and processes known from the general debate about OD and HRD are applied, such as

- **Combining top-down and bottom-up approach:** In the beginning there is an individual or a group, who has an idea to start a greening project in a TVET institution. He or she will draft a project sketch and present it to the senior management; if senior management is convinced and committed, and the sketch is approved, the concept can be further developed and implemented. Initiatives from the “grassroots”, i.e. from lecturers or students, are necessary and must be encouraged. However, this strategy must be supplemented with statements of willingness, the provision of resources and an acknowledgment of the activities at the “bottom” by the top management (Motto: greening is also a matter for the boss). As experience shows: In a long-term

perspective, organisations can only be greened if both approaches are pursued simultaneously.

- **Assigning promoters on both strategic and operational level:** Without committed individuals who are dedicated to the topic and who press ahead with it in their organisation, greening will remain a marginal issue. If it involves more than individual measures that are relevant to the organisation, it is important that a person is found who can support and promote the project as a functional and process promoter (project or process manager) in terms of contents and organisation. On the other hand, it must be ensured that the project also has a promoter on senior management level who is sufficiently accepted and who has enough decision-making authority to implement the system. The top management has to set a good example. Simple changes in attitude can be adopted much more easily if the top management is committed and communicates this emphatically. There is no chance for implanting green issues in a TVET institution systematically and enduringly, if

there is no sufficient commitment of and support from the senior management.

- **Systematic approach:** The greening TVET institutions concept provides a holistic structure to implement greening issues systematically into relevant fields: campus, curricula, conducting green research activities, cooperation with partners and other institutions on community level, development of a green culture and integration of green issues into the school's management system. Besides the greening TVET institutions concept the ISO 14001 is an established environmental management standard that could be used to embed greening activities into the vocational college's management system systematically. The Eco-Schools approach shows how greening processes can be implemented following a people-oriented approach.
- **Creation of a suitable organisational structure:** Generally, to plan, manage and document coordinated activities for greening an institution, temporary cross-status project teams are formed to look after the implementation process and to support the process manager on operational level. The establishment of a green committee allows involving representatives of all relevant stakeholders. It can steer the greening process on strategic level and ensures acceptance.
- **Cooperation with OHAS, quality and facility management:** Responsible persons in occupational health and safety (OHAS), environment protection, quality management and facility management are "natural allies" in a TVET institution who should be involved when starting a greening process. They have expertise in relevant topics, know the institution well, and are generally open to the new topic of "greening".
- **Linking individual and organisational learning:** Particular effects can be expected if the environmental learning of staff and students and the environmental learning of the organisation are linked with each other. Therefore, it is important to train people with regard to the requirements of the greening TVET institution and to give feedback on what the institution has done and already achieved through its greening efforts.

- **"Living" the greening process:** A green TVET institution cannot be created from one day to the next. It is a long-term process that, on the one hand, is time-bound and needs a high level of commitment and financial resources as well as expertise, and on the other hand, is a basically open process, and potentially at risk. The creation of guiding principles and participative organisational structures, as well as the orientation along environmental management systems are important prerequisites. But that alone cannot ensure that the corresponding measures will be permanent. The system freezes in its routine if it is not revised from time to time and filled again with life and more or less spectacular activities.

2.3 Getting started: Greening TVET institutions in seven steps

A systematic procedure to start and implement a process on greening TVET institutions contains seven steps that any vocational college etc. can adopt and adapt to the respective framework conditions:

- 1. Assignment of a process manager and establishing a green committee:** Like any other process greening needs somebody who takes on responsibility and manages and operates the process.
- 2. Establishing a green committee:** Representing all stakeholders, the green committee is the central forum for steering the greening activities.
- 3. Informing and involving stakeholders:** Greening an organisation cannot be achieved by individuals but requires the involvement and collaboration of all stakeholders
- 4. Developing a green policy and strategy:** In the green policy the TVET institution demonstrates its commitment to a sustainable development; its strategy contains its strategic goals in regard to greening.
- 5. Conducting an environmental review:** A systematic integration requires a review and assessment of the environmental impacts of the TVET institution.

- 6. Developing a greening programme:** The greening programme reflects the green policy and strategy and provides information about objectives, activities, schedules and responsibilities.
- 7. Implementing, monitoring, evaluating and consolidating of greening activities:** To find out whether or not the targets laid out in the

greening programme are successfully achieved, the progress is regularly monitored and measured; once a year the greening activities are reviewed by senior management; new focus areas, aims and activities are fixed; the greening activities are continued, disseminated and consolidated.

Please note:

Although implementation of green issues costs a lot of effort we should not get lost in details, but always keep in mind the global and regional challenges TVET institutions have to meet. When starting a process of greening, TVET institutions show that they are committed to take on responsibility for a sustainable future. In this respect greening is much more than separating waste, consuming less energy or having a poster presentation. Greening TVET institution's vision is to educate and train a skilled and capable workforce that contributes to and benefits from a growing greening economy in its country. Their mission is to provide adequate skills development which meets the requirements of the greening economy and contributes towards achieving their country's targets in regard to sustainable development.



Step 1: Assignment of a process manager

Like any other process, greening a TVET institution needs somebody who takes on responsibility and manages and operates the process. We call this person "Process Manager". He or she is the internal and external contact person for greening the respective TVET institution.

The process manager's main tasks are:

- internal and external communication on greening;
- coordinating the green committee;
- coordinating the action teams (if applicable);
- preparing, chairing and documenting the meetings of the green committee;
- informing the members of the green committee about the greening TVET institutions concept;
- developing a concept on greening the institution coordinated with senior management and green committee;
- developing and implementing a school-specific procedure on greening;
- preparing, implementing and documenting an environmental review;
- delegating tasks and setting time limits;

- regularly reporting to the senior management on greening performance;
- providing training for staff and students, if special knowledge and skills are required;
- supporting the involvement and recognition of the top management;
- attaining staff support beyond individual areas and functions.

If possible the process manager is supported by one or several temporary action team(s) of committed people. This can be mixed groups (staff and students) or homogeneous groups (staff or students). These action teams - it does not matter what they are called - are located on operational level. They help the TVET institution reduce its environmental footprint and are focussed on the following:

- special topics, e.g. preparation, executing and assessment of an awareness campaign;
- special steps of procedure, e.g. review of energy consumption and development, implementation of improvement measures;
- special locations, e.g. a special campus;
- special key elements of the greening TVET institutions approach, e.g. green campus, curriculum, culture or quality management.

Skills required by a process manager (examples):

- Good knowledge of the vocational school's structure and operating procedures
- Basic technical understanding
- Sound knowledge of the greening TVET institutions concept
- Involvement and enthusiasm for the subject of greening
- Communication skills

Suitable positions in the TVET institution for becoming a process manager on greening (examples):

- Marketing expert
- Facility manager
- Occupational health and safety officer
- Quality manager
- Campus manager

Step 2: Establishing a green committee

Additionally to the assignment of a process manager, a green committee should be established. The green committee should represent all stakeholders; it is the central forum for steering the greening activities and is located on a strategic level. The process manager shares responsibilities and tasks with the members of the green committee. Regular meetings should take place for coordination. The frequency of the meetings is based on demand; it should, however, take place once every quarter.

The green committee's main tasks are:

- ensuring that all stakeholders of the school community are represented in the decision-making process;
- integrating the greening programme within the school development plan;
- ensuring acceptance and "open doors";
- steering and coordinating the greening process at the school;
- supporting the process manager and the action teams;
- coordinating, planning and implementing the projects (according to budget, time and quality);
- developing an effective organisational structure to integrate the greening activities into the operational organisation;
- developing, implementing and monitoring the school's green policy and strategy;
- developing a greening programme;
- monitoring and evaluating greening activities.



Members of green committee of Boland College | PHOTO: BOLAND COLLEGE

Lessons learnt by South African project managers

... in the initiation phase?

- Selection of the strategic persons to be a part of the initiative is important
- Commitment from the top management; buy-in from staff and ownership of projects is necessary.
- Questions have to be answered such as: Are our support staff and lecturers knowledgeable and equipped to carry out this type of project? Who will be responsible for what?
- Do the site conditions allow for onsite waste management options? It is important for campus staff or learners to accept and fully understand the meaning and purpose of waste management.
- Public speakers for overall Environmental Health issues can assist with guidance and talks on several greening projects.
- The complete buy-in at all levels of the organisation is needed.
- It is important to have time to answer questions. People have a lot of questions about a new concept they do not understand.

... in the planning process?

- Development of guiding documents.
- Are the resources available? Can we afford them? Can we maintain them? What should we start with as priority?
- Developing a programme .
- Clear assigned roles and responsibilities. Effective teams are essential as well.
- Get everyone on board, stakeholders, other campuses.
- Set realistic and achievable goals.
- Again you have to make time – I have a lot of ideas but if there isn't enough time to implement, the process will collapse.
- Communication process -it is important that everyone understands the Green Campus concept and its importance.

... in the implementation process?

- The challenge here has been finding suitable time to implement the initiative.
- Support from management and key staff members and availability of resources is crucial.

- Clear programme objectives must be set and also clarity on start and end dates, responsible person/department for activities and allocated funds.
- Integrated waste management planning is a dynamic tool including aspects that range from policy-making and institutional development to technical design of integrated solutions for the handling and disposal of waste. All the following procedures will be taken into account:
The overall waste problematic
 - ◊ Legislation
 - ◊ Description of national waste policy and prevailing principles
 - ◊ Description of objectives set up in specific areas
 - ◊ Assumptions for planning
 - ◊ Proposals of scenarios
 - ◊ Setting goals and targets
 - ◊ The changing of mindsets of all role-players and stakeholders
 - ◊ Time is also a deciding factor.
 - ◊ Communication is very important.

Step 3: Informing and involving stakeholders

Greening an organisation cannot be achieved by individuals. It requires informing and involving stakeholders. Important internal stakeholders are:

- CEO / principal
- Senior management
- CFO
- Campus manager
- Teaching staff
- Admin staff
- Facility management
- Students

Important external stakeholders are:

- DHET
- SETAs
- Local government
- Private institutions (e.g. contractors, Eskom)
- Companies
- Local industry
- Parents

They can all support or hinder the greening process to a certain extent. Internal and external stakeholders should be regularly informed about the greening activities of the TVET institution and should be involved in the greening process, as much as possible.

Step 4: Developing a green policy and strategy

The TVET institution's commitment to sustainable development finds its expression in a green policy.

Its strategy contains its strategic goals in regard to greening.

Environmental policy

According to ISO 14001, the organisation's environmental policy has to:

- be appropriate to the organisation's nature, scale and environmental impacts caused by activities, products and/or services;
- include a commitment to
 - ◊ continual improvement,
 - ◊ prevention of pollution,
 - ◊ compliance with all applicable legal requirements, and with other requirements to which the organisation subscribes;
- provide the framework for setting and reviewing environmental objectives and targets;
- be communicated to all employees and others working on behalf of the organisation;
- be available for the public.

The green policy is meant to

- present commitment regarding greening to internal and external stakeholders
- and lead the greening activities in the college in a certain direction.

Sometimes it is said that an eco-policy is just another policy paper that will disappear in the drawer. If this happens in an institution, then the basics of organisational learning and development as well as the advantages of managing by objectives and processes are not understood.

Step 5: Conducting an environmental review

A systematic implementation of green issues requires a review of the direct and indirect environmental aspects and an assessment of the environmental impacts of the TVET institution.¹ The environmental review is crucial to understanding the current environmental situation in the organisation and provides the basis of the TVET College's greening programme.

It has to be determined which domain the review should refer to. This can be the whole college, a campus or a training workshop. It is also possible to focus on one topic such as energy, water and/or waste or several topics. However, the analysis should always cover all six key elements of the greening TVET institutions approach.

A rough analysis will shed light on the energy and resources demand profile and the amount of consumption in past years:

- **Survey consumption rates:** Subscriber contracts and tariffs, delivery receipts and bills depict an overview over amount and temporal progression of the overall energy consumption in the TVET institution for the various energy-forms and media.

¹ *Direct* environmental aspects are activities over which an organisation can be expected to have an influence and control (e.g. consumption of material, energy and water; waste and waste water production; usage of hazardous substances; CO₂ emissions and biodiversity on the school grounds. *Indirect* environmental aspects on the other hand are actual or potential activities over which the organisation can be expected to have an influence, but no control, such as positive environmental impacts by environmental education/ training, traffic or environmental impacts of suppliers.

In the context of greening TVET institutions it is important to emphasize that a college accepts the challenge of sustainable development and that it responds to it in a college-specific manner. This includes a commitment to continuous improvement of the ecological performance but focuses on educating and training people to be able to contribute to the greening of economy and society of the respective country. It should be clear that the green policy should be an expression of the overall college's mission statement and by no means separated.

- **Detect “energy-paths“ through the college:** Which installation is provided with which energy source?
- **Identify main consumers:** The energy consumption can be allocated to individual consumers by electricity meters, heat counters, gas meters as well as control-reports from meter controllers. In case there are no meters, the energy-demand of individual installations can be estimated by their default capacity, average capacity and service-time (service hour counter).

In the same way, materials (raw materials, operating and auxiliary materials), water consumption, waste production etc. can be analysed.

It is highly recommended to prepare the results in the form of charts and graphs.

Additionally, good practices should be considered in the environmental review as well: Do lecturers already integrate green issues in lessons or training courses? Are greening activities already taking place like turning off lights and computers when not needed, making full use of paper and materials, recycling in the classroom or encouraging waste separation?

The relevance of an environmental aspect can be assessed in regard to:

- Their ecological impact (high impact, average impact, low impact), and
- the opportunities to influence the aspect (high, average or low influence potential).

The greening process should focus on environmental aspects which are ecologically relevant and where the TVET institution has opportunities to improve its performance.

Step 6: Developing a greening programme

The greening programme reflects the green policy and strategy, and provides information about objectives, activities, schedules and responsibilities. A greening programme is the core of the greening process in the TVET institution.

Developing a greening programme is divided into two phases:

1. Identification of fields of action

Linked to the college's strategy and based on the results of the environmental review, relevant fields of action are to be identified. Of special interest are improvement opportunities that are easily implemented and cause few or no costs, so-called none or

marginal investment related measures ("low-hanging fruits").

If you are a beginner in greening, we suggest focusing on a few relevant topics, such as energy efficiency, water saving and/or waste management. You should consider how the school's performance can be improved in respect of this or these topics in all six key factors of greening TVET institutions.

2. Determination of objectives and improvement measures

For the selected fields of action, concrete objectives and improvement measures or projects must be derived. A detailed documentation of the individual measures in terms of a chart is highly recommendable. Along with this very measure, responsible persons, estimated costs and the final deadline will be noted.



Please note:

Keep the plan practical, focusing on what can be achieved realistically in light of technical equipment, budget, schedules, school breaks and graduation dates.

Not every objective can be achieved in one year. Better to set smaller targets (e.g. reducing electricity consumption at XY campus by 10% until January 2015) than bigger ones (... by 30% ...).

Another target in this respect can be defined in the following year.

The sum of these different objectives and activities form the greening programme. It has to be discussed in the green committee and approved by senior management.

Step 7: Implementing, monitoring, evaluating and consolidating of greening activities

The greening activities are being implemented or supervised by the responsible persons or action teams respectively. To find out whether or not the targets laid out in the greening programme are successfully achieved, the progress is regularly monitored and evaluated.

This is done by the process manager in close coordination with the green committee. The green committee possibly also has to decide what to do to support the implementation of special activities if they are faced with unforeseen obstacles.

The implementation of the improvement activities and projects should be embedded in an information and awareness raising campaign. Everybody in the college or at the campus should know that the college is committed to sustainable development and that everybody is requested to contribute.

The implementation of the greening activities should be supported by monitoring activities. Monitoring is the continuous and systematic observation and recording of programme progress. This is measured by regularly examining targets on the basis of indicators or milestones. Monitoring should be a regular part of programme management, the responsibility therefore lies with the process manager and the green committee.

Key questions for programme monitoring are:

- Was the programme implemented as designed and planned?
- Were the planned activities implemented and were the planned outputs reached?
- Did all the intended beneficiaries receive the intervention / did they benefit from the programme?
- Was the programme implemented in the same way across multiple sites (e.g. different college campuses)?

The purpose of programme monitoring is to improve the current and future implementation of the programme or initiative.

After a year an internal evaluation should be conducted, focusing on the outcomes of the programme/ initiative. Evaluation is the systematic examination of the value and benefit of a programme. An evaluation provides a judgment about the merit or worth of a programme and it generates knowledge about what has worked under what circumstances. The internal evaluation should focus on the outcomes of the programme, judging effectiveness and efficiency. The results of the evaluation could potentially inform senior management whether to continue or terminate funding, therefore it is vital that the results are available before the colleges' budget is drawn up for the next financial year.

Key questions to be answered during an evaluation are:

- Were the desired outcomes achieved?
- How cost effective was the programme? Did we get value for money?
- What has been a success? Where have we failed?
- What lessons can be learnt?

Additionally, suggestions for new objectives and activities should be considered.

The purpose of an outcome evaluation is to assess effectiveness, efficiency and if possible sustainability, and based on this make a decision about continuation, termination or amendment of a programme needs to be made.

The evaluation results should be summarised in a report and be presented to both the green committee and the senior management. It is important that the senior management is involved, because it is the task of senior management to review greening activities to ensure its continued suitability, adequacy and effectiveness. This management review shall address the possible need for changes to green policy, focus areas, objectives and activities in the light of audit results, changing circumstances and the commitment to continuous improvement.

The results of the management review should be integrated into the evaluation report and presented to the college staff and learners.

In the following year the greening activities are continued, disseminated and consolidated.

Please note:

The evaluation report should not only contain programmes and statistics, but also success stories and profiles of people involved in the greening process. This is an important issue, because the feedback on the consequences of the greening activities can influence attitudes and values of people and thus enhance eco-friendly behaviour.



The following table shows an example of a monitoring matrix for the greening college initiative that could be used as a template for planning, monitoring and evaluation purposes.

GOAL: COLLEGES TO BECOME ROLE MODELS FOR ENVIRONMENTAL FRIENDLINESS, A SOURCE OF INSPIRATION, AN INNOVATIVE AND PROFOUND TRAINING PROVIDER AND AN ACCEPTED STRATEGIC PARTNER FOR SUSTAINABLE DEVELOPMENT OF THEIR REGION

OBJECTIVE 1: TO REDUCE THE CARBON FOOTPRINT OF STUDENTS, TEACHERS AND STAFF OF PARTICIPATING INSTITUTIONS (GREEN CAMPUS OBJECTIVE)

ACTIVITY	OUTPUT	EXPECTED OUTCOME	OUTCOME INDICATOR	DATA TO BE COLLECTED
Identification of energy sources and other relevant resources	Consumption is recorded and analysed	Electricity consumption per college/per campus has been reduced	Consumption is reduced by x% or x Rand per month	<ul style="list-style-type: none"> Records of energy consumption Records of municipal account
Identification of amount and type of waste produced	Waste is avoided, waste is recycled and waste is managed adequately	Amount of waste per college/per campus has been reduced	<ul style="list-style-type: none"> Amount of waste that is reduced Amount of waste that is recycled 	
	Adequate sources of renewable energies are in practice	Electricity consumption per college/per campus has been reduced	Consumption is reduced by x% or x Rand per month	<ul style="list-style-type: none"> Records of energy consumption Records of municipal account
Formalisation of green activities	"Greening" aims are included in the college mission statement and an environmental or energy management system is implemented	College staff and students are aware and share responsibilities and accountabilities	College staff and students show an increased amount of environmental awareness and involvement in "greening" activities	Pre- and post- assessment of environmental awareness and activities

**REDUCE THE
CARBON
FOOTPRINT**

OBJECTIVE 2: TO MEET UPCOMING SKILLS FOR CLEAN AND GREEN JOBS (GREEN CURRICULUM OBJECTIVE)

ACTIVITY	OUTPUT	EXPECTED OUTCOME	OUTCOME INDICATOR	DATA TO BE COLLECTED
Integration of green skills requirements into existing course (green basic skills)	Number of existing courses with green basic skills	Students of existing courses have acquired green basic skills	Number of students enrolled in / graduated from existing course with green basic skills	Enrolment and graduation register
Design of new courses oriented to green skills needs (with focus on energy and resource efficiency and renewable energies)	Number of new courses	Students have acquired necessary skills in the field of energy and resource efficiency and renewable energies	Number of students enrolled in / graduated from new green skills courses	Enrolment and graduation register
Procuring of adequate equipment for green skills courses	Number of classrooms / workshops with adequate equipment for green skills courses	Quality of teaching has improved	Student satisfaction has increased	Satisfaction of students with quality of training
Capacity development of teachers and instructors	Number of teachers/instructors that received training	Quality of teaching has improved	Student satisfaction has increased	Satisfaction of students with quality of training

OBJECTIVE 3: TO ACTIVELY PARTICIPATE IN THE SUSTAINABLE DEVELOPMENT OF THE COMMUNITIES (GREEN COMMUNITY OBJECTIVE)

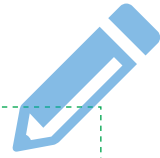
ACTIVITY	OUTPUT	EXPECTED OUTCOME	OUTCOME INDICATOR	DATA TO BE COLLECTED
Offering of formal and informal training for community members	Number of trainings offered to community members	Community members received training and have increased their knowledge	Training assessment	<ul style="list-style-type: none"> • Number of trainings • Duration of trainings • Type/Content of training • Satisfaction of training participants with training • Dissemination of training content
Supporting projects to solve local problems	Number of local projects supported	Living conditions of local communities have improved	Assessment of project implementation	<ul style="list-style-type: none"> • Implementation according to project plan • Type of problem addressed • Satisfaction of project implementation by local community • Local problem solved
Providing training courses for local industry concerning green issues	Number of trainings offered to local industry	Local industry has a better understanding about green issue	Training assessment	<ul style="list-style-type: none"> • Number of trainings • Duration of trainings • Type/Content of training • Satisfaction of training participants with training • Dissemination of training content

OBJECTIVE 4: BRIDGING CAMPUS-WIDE INITIATIVES TO RESPOND TO THE NEEDS OF INDUSTRY AND COMMUNITY (GREEN RESEARCH OBJECTIVE)

ACTIVITY	OUTPUT	EXPECTED OUTCOME	OUTCOME INDICATOR	DATA TO BE COLLECTED
Initiation of external research interventions in cooperation with universities, research institutes and industry	Number of external research interventions	tbd	tbd	tbd
Initiation of internal research interventions	Number of internal research interventions	tbd	tbd	tbd

OBJECTIVE 5: TO STRENGTHEN ETHICAL STANDARDS, ATTITUDES AND BEHAVIOUR (GREEN CULTURE OBJECTIVE)

ACTIVITY	OUTPUT	EXPECTED OUTCOME	OUTCOME INDICATOR	DATA TO BE COLLECTED
Involving staff and students in improvement processes	Number of staff and students involved in improvement process	Involvement of staff has increased ownership, sustainability and understanding of the greening college initiative	Number of staff members and students that <ul style="list-style-type: none"> • Know about the initiative • Support the initiative • Participate in the initiative 	Staff and student pre- and post intervention interviews
Involving staff and students in green working groups	<ul style="list-style-type: none"> • Number of green working groups • Number of staff and students involved in green working groups 	Involvement of staff has increased ownership, sustainability and understanding of the greening college initiative	<ul style="list-style-type: none"> • Would continue with the initiative after the pilot phase 	Staff and student pre- and post intervention interviews
Initiating competitions between workshops or groups of students	Number of competitions carried out	Involvement of staff has increased ownership, sustainability and understanding of the greening college initiative		Staff and student pre- and post intervention interviews
Initiating public relation activities to showcase green activities	Number and type of public relation activities	Awareness of the greening initiative has increased among the wider community	Number of community members that: <ul style="list-style-type: none"> • Know about the initiative • Support the initiative • Have implemented certain green activities 	Community profile pre- and post-intervention



Recommendations of South African project managers

- Select your team wisely, the team you select can make or break your initiative.
- Select a dedicated group of individuals from different departments to establish a green committee. Assign clear roles and responsibilities to the groups.
- Have the head of the institution be on board and pass on the message of the new direction (greening) the school will be taking.
- Engage students as often as possible.
- Don't forget to engage general workers.
- Start awareness immediately to ensure all are aware, so that all efforts towards greening are well understood and procedures are followed correctly.
- Carry out energy audits, determine what your average cost and saving would be for going green via energy and water etc. then present it to top management with statistics as they would be more prone to accept when figures are presented.
- Scope of a master plan: what are the types and amounts of waste in studied geographical areas? What are the priorities and needs of different sites? Specific objectives as they are provided either by legislation or by specific local priorities and conditions.
- Get yourself thoroughly organised and informed on the process and do lots of research
- Start small – implement an idea you can handle with your normal workload.
- I have the full support of my campus manager. He is also very much inclined towards sustainable living and Green Campus.
- Create a community where different colleges can interact and share ideas; schools should not be an island but a great sharing hub.
- Consider catching up with other institutions and be on an international level where greening is concerned as in my personal opinion, we may have started later than others globally.
- There are reuse or recycling opportunities available for many waste streams, even hazardous waste. Reuse and recycling options should be considered before other options. Communities should plan for waste segregation in advance of an incident in order to increase the efficiency and effectiveness of their waste management activities.
- GIZ interventions to establish a proper foundation phase of your personal development.
- Add green modules into the curriculum.
- Awareness could also be more costly in terms of time, more so than financially, so there is no excuse not to start awareness immediately. As soon as a resource is installed, all those involved need to understand its functions and purpose.

3

GREENING TVET INSTITUTIONS: EXAMPLES AND EXPERIENCES FROM SOUTH AFRICA



3.1 Procedure

After running two kick-off workshops in Johannesburg and Port Elizabeth in May 2013, which were attended by representatives of DHET, MerSETA, EWSETA and FET Colleges, as well as after several technical advice meetings at interested FET Colleges, a first group of representatives of TVET colleges was trained in a two-week course on “Greening Colleges in practice” in Germany in June 2013.

The overall objective of the training course was to enable the participants to initiate, coordinate and sustain selected institutional greening strategies and activities at their TVET colleges. On completion of the programme, the participants should:

- be familiar with international approaches of greening colleges and be able to critically review it with regard to the TVET college situation (challenges and solutions);
- have outlined their aims and ideas as well as the challenges to be tackled in regard to the greening process in their TVET colleges;
- be able to identify, implement, manage and evaluate environment projects within their TVET colleges;
- be aware of the importance of internal and external communication;

- have developed concrete transfer activities for the implementation at their workplaces;
- have established a community of practice.

In the training course the tasks of TVET in a green(ing) economy were discussed as well as the greening TVET institutions approach. German vocational colleges, advanced in greening, were visited and explored. Reference systems for greening TVET institutions were analysed in regard to how they could support a systematic procedure of implementing green issues in vocational colleges. Communication and cooperation in processes of greening TVET institutions was another focal topic in the course. Within the course the participants developed a transfer project with objectives as well as a procedure and detailed activities to be implemented in the individual TVET colleges after the course.

The participants continued communication and cooperation between each other on the Global Campus 21, the GIZ knowledge portal for international advanced training and cooperation. If needed they got technical support on questions coming up in regard to their greening projects.

In November 2013, another group of representatives from TVET colleges interested in participat-

ing in the Greening TVET Colleges Initiative were trained in a one-week course entitled “Introduction to the Greening FET Colleges Initiative” in Johannesburg. The objectives and topics were similar

to the two-weeks training course, but less ambitious. Also here, participants developed transfer projects to be implemented after the course and they joined the online-community as well.

Importance of exchange with other TVET colleges

The exchange with other TVET colleges participating in the Greening TVET Colleges Initiative has been shown to be very important. Exchange of ideas and experiences as well as spontaneous feedback and recommendations from colleagues – that means: learning from each other – is an important factor not only for individual learning, but also for learning of all the colleges involved and the whole GC community.



Communication and cooperation with others was very important simply because it helped me to learn from other TVET Colleges in South Africa and was an opportunity to share best practices with one another.

Mr Kabedi Mpopote, Boland College



Exchange with other TVET colleges was brilliant and helpful; it gave us a wide range of spectrum in greening initiatives. Some colleges did a lot and that has built confidence in us. We have learnt some lessons, different approaches and experiences. We were impressed by the PE and Boland College with their LED lights being installed by students. We are trying to follow their examples.

Ms Gloria Tshabalala, Central Johannesburg College



It was highly beneficial to see what other campuses had been doing in regard to the greening of TVET Colleges. It has allowed us the opportunity to implement ideas which we have not thought about at our campus as well. It has also allowed us to measure effectiveness of ideas with low risk of trial and error, i.e. if a system had been implemented at a college and it was not successful we at EMC could stay away from the same and not risk spending time and resources. Instead, we focussed on implementing ideas that were popular and successful.

Mr Ziyaad Smith, Eastcape Midlands College



No campus sites are the same, so it is quite interesting to see how complicated and challenging change is. It is important to form work groups composed of people from different parts of the institution to address strategy issues.

Mr Terence Slade, Northlink College



The sharing of best practice surely beats reinventing the wheel to find that you have duplicated what someone else had already discovered to be working. The exchanging of ideas also inspires all stakeholders to achieve the best results and to work more eagerly at making a success of the greening process.

Ms Raquel Marinus, Northern Cape Rural TVET College



It was also good at the workshop in November 2013 to hear what everyone had done so far.

Ms Sonja Spies, Port Elizabeth College



The exchange with other colleges participating in the initiative was very important and extremely helpful.

Ms Sheritha Singh, Umfolozi College

In the following section the first interim results of the participating TVET colleges are presented in regard to the pillars of the greening TVET institutions approach. The colleges focussed on easily re-alisable topics like efficient use of energy and water

and waste management and they did this very successfully. On the other hand, the examples show that most of the colleges proceed systematically and cover in sum all six key elements of the greening TVET institutions approach.

3.2 Interim results

3.2.1 Green Campus

Characteristics

Based on the philosophy of practicing what is being preached, the intention is to reduce the ecological footprint of students, teachers and staff within the TVET institutions. The operation of the buildings, machines, equipment, tools and materials, as well the design of the buildings and the school grounds shall become environmentally and resource friendly.

The most important fields of action are:

- reduction of energy consumption,
- reduction of water consumption and pollution,
- reduction of waste generation and recycling,
- control and correct handling of hazardous materials,
- minimisation of air pollution,
- environmentally friendly travelling and transport,
- healthy and environmentally friendly food and food services,
- green landscaping & consideration of biodiversity on the school ground,
- green construction & buildings.

Not all topics have to be covered at once. For beginners the focus should be mainly on:

- reduction of energy consumption,
- reduction of water consumption and pollution,
- reduction of waste generation and recycling,
- control and correct handling of hazardous materials.

Examples: Efficient water consumption

Boland College: Installation of drinking fountains



Photo: Boland College

In order to reduce the use of plastic bottles at the campuses and to introduce a system that seeks to recycle water back into the garden drinking fountains were installed at all five campuses/sites: Stellenbosch, Strand, Worcester, Paarl and Caledon. The initiative, originally taken by the facilities

department, was well accepted by the students. The results are a cleaner and greener campus and reduced water wastage.

Boland College: Installation of motion sensing water taps



Photo: Boland College

A lot of water is wasted in bathrooms because taps are not turned off properly after usage. As a result of a decision by the college's Executive Committee to revamp

the facilities and make them as friendly to the environment at large, motion sensing taps have been successfully installed at the head office.

Examples: Efficient energy consumption

Boland College: Installation of motion sensing lights



Photo: Boland College

Often lights were not switched off after leaving the rooms. The lights would also be "on" during broad daylight. In order to reduce this wastage of electricity,

motion sensing lights have been installed at the head office. Even though this system is a bit more expensive than usual, the assets and procurement department is convinced that there will be a significant saving on the electricity bill on the long run.

Boland: Small stickers on all light switches in the college



Photo: Boland College

Everybody, management, staff and students can make a great impact on their immediate environment (offices, computers, etc.).

In order to create awareness on saving energy, stickers have been designed by the Stellenbosch campus and developed by the procurement channels of the marketing and corporate communications department. The green team approved the designs and now they are placed on light switches, PCs and printers all over Boland College's campuses and sites.

Boland College: Greening the fleet



Photo: Boland College

In order to reduce both air pollution caused by exhaust fumes and the fuel bill, the executive committee and college council of Boland College decided to change

the entire fleet to more eco-friendly vehicles. VW POLO 1.4 diesel BLUEMOTION were procured and branded for all five campuses and head offices. Because these vehicles are fuel efficient, there has been a significant drop in the fuel bill of the college.

Eastcape Midlands College: Natural instead of electric lighting



Walkway with clear sheeting | Photo: Eastcape Midlands College

On Brickfields Road Campus green issues were made provision for in the process of reconstructing a building. Wherever possible, natural lighting was considered. Experience shows: Even in classrooms natural lighting

is sufficient so usually there is no need for electric lighting. The photo shows a walkway which is approximately 30 metres long. On the roof there is clear sheeting, so there is no need for electrical lighting as well. There is electrical lighting installed, but there is no need to use it during the working hours.

Northlink College: Saving of 10 % of the college's energy cost

The green committee and the principal decided that the focus of the "Northlink goes green" campaign should be first on energy to save 10 % of the energy cost of the entire college (all seven campuses). The principal agreed that all savings in the college's electricity bill could be used to fund further green projects. Data was collected on electricity costs per campus and it was discovered that the total electricity bill for Northlink College per annum was approximately R3 million. At Belhar Campus a few spot checks over a period of a month revealed that not everyone was energy conscious and although computers were off at night, they were left on during the day, even though they were

not used. Emails were sent to all staff to switch off lights, computers and equipment when not in use. Additionally, the green marshals on campus reminded the people to save electrical energy. Green marshals were also invited to visit a hotel that has very green features in terms of design and layout. This was done to inspire them to look at their campuses in a new manner so that proposals of how change can occur on their campuses could be spearheaded by them.



A light still on during the day | Photo: Northlink

The situation with the switching off of lights is better than before the campaign but still lights are randomly left on. In order to improve the situation the IT department

did some research and is in the process of installing more energy efficient computers in the computer laboratories. This has the effect that the computer rooms will require almost 20 % less power and as the computers use less power and dissipate less heat, less dependence on energy hungry air-conditioners is required, adding to our overall energy savings. A quotation to replace fluorescent lights in offices and offices with energy efficient fluorescent lights and LED lights was sought. It is not feasible for the college to embark on this project yet.



Replacement of old style lights with energy efficient lights | Photo: Port

Port Elizabeth College: Electricity savings

An advisor from an electrical company was called in to check the state of lights in Victoria campus and advise on energy efficiency measures, budget and

ROI. The outcome was an audit report on all light sources on the campus, with a proposal on upgrading to new, energy efficient technology (CFL and LED). It also includes costing and ROI calculation. At the moment the project manager is trying to get the budget released for this upgrade.

Examples: Waste management

Eastcape Midlands College: Establishment of a waste management system



Photo: Eastcape Midlands College

One of the first projects of the greening committee was to improve the college's waste management system. Service providers have been procured, a

needs analysis has been conducted, a programme for waste management has been identified and by now a waste management and recycling programme has been established that will be rolled out in all campuses. The college uses the already existing bins and puts stickers on them in different colours according to the different types of waste: plastic, glass, tin cans and paper. The stickers were available at the waste management company. Inside the buildings cardboard boxes are used for sorting paper from waste. The boxes have been provided by the waste management company for free. Now the green committee is thinking about communication with students: What do they have to know to separate the different kinds of waste? In this respect an awareness raising campaign is planned.

On Park Avenue campus there is an internal waste management site where the waste is collected. The waste company comes once a week to take it. On a day of action the different kinds of waste were separated. Even managers and lecturers participated in this action to show that management and lecturers are also committed and waste separation is something everybody has to consider, not only students. It was a single action. But now it is a running system and usually happens weekly. The company supplies the bags and big bins, etc. and gives the college a small rebate when the waste is separated.

Northlink College: Cooperation with a recycling company

Initially research was done on how waste management at each campus could be realised. It was thought that the resources at each campus could be used to fulfil this function. But this didn't work. As a pilot the contractor which provided the cleaning of the campuses was used at Belhar Campus to start collecting cardboard, copy paper, plastic bottles and aluminium cans. However, some of the cleaning company staff soon did only recycling and no clean-

ing, and thus another solution was sought. The project manager for greening, Mr Terence Slade, engaged an independent recycle firm. This firm now collects the recyclable products (all the above mentioned recyclables, as well as scrap metals and scrap copper), weigh it and pay the college according to predetermined /agreed rates for products recycled. This is taking place regularly on all campuses.

Going for an independent contractor has the advantage that normal collection of recycled products can be managed by the contractor and the college can



The first bag of plastic bottles goes away for recycling | Photo: Heinrich Snyders

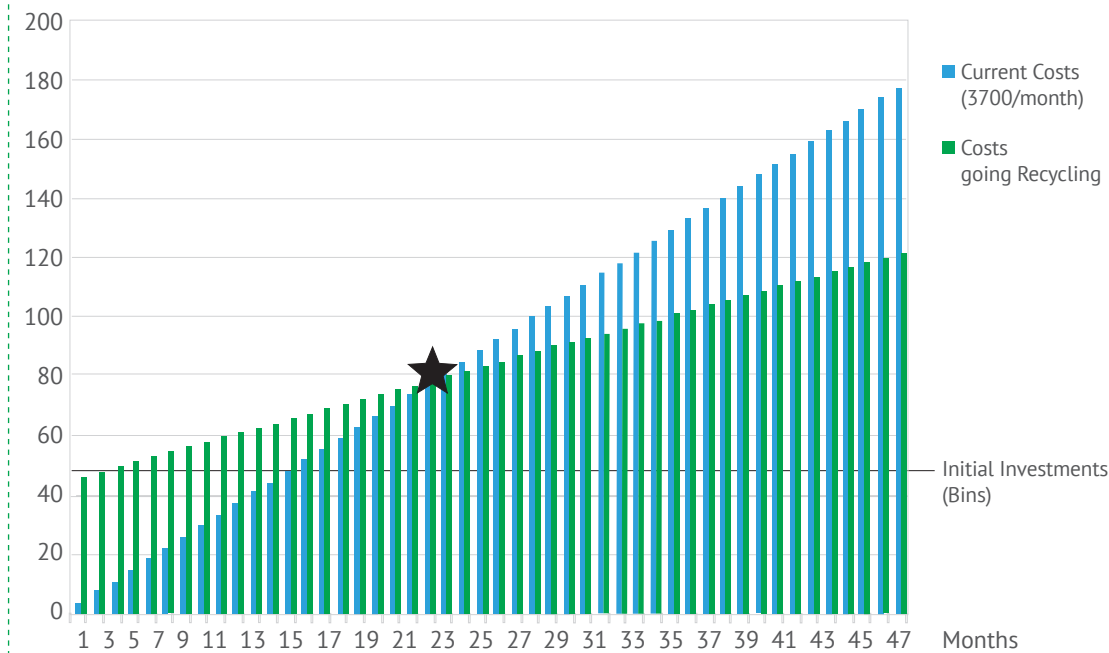
continue with its functions without intervention. But the idea to have the capacity in-house eventually, is still there. Mr Heinrich Snyders, project manager assistant for greening at

Northlink College, draws the following conclusion: *"Maybe in the college sector it is better to get in outside help initially. Trying to manage the recycling ourselves was not an option as all role-players have other focuses at present. However, they see the recycling taking place and their mind-sets are being changed slowly to see that recycling is an essential part of college life and should become part of normal existence outside college life as well."*

Port Elizabeth College: First steps in regard to establishing a waste management system

At PE College one of the major steps towards greening was identified as being waste management. At present, the waste is not separated at all. It is removed from the different campuses once a week by different service providers. All is then loaded to the municipal landfill site. The situation is difficult to handle, since there is no municipal recycling service in place. So the first step was doing research for different private service providers and initiatives offering waste separation and recycling services. A specification defining the requirements for an appropriate service provider was written and quotations from three different service providers and also for recycling bins were obtained. For the calculation of budget needed for the new recycling bins an Excel sheet was designed to count all places where bins, should be placed and multiply them with the prices of chosen models.

Costs for Recycling @ Victoria and Russel Road Campus



Calculation of cost of recycling | Chart: Port Elizabeth College

At present the project manager is trying to get final approval for the purchasing of bins and the switch-over to new service providers. Once this will be in place, staff on the different campuses will be informed and awareness measures will be planned.

Port Elizabeth College: Office paper collection



White office paper is separated and collected in special cardboard bins Photo: Port

In the course of finding a new service provider for recycling, a young lady who had just started up her waste management company offered to provide cardboard boxes for three different campuses to collect office paper.

She started to bring in the boxes and placed them in different strategic areas. She regularly collects the paper and recycles it.

Port Elizabeth College: Toner cartridges collection

Empty cartridges are collected by an agent for the Chris Burger/Petro Jackson Fund. The cartridges get collected, refilled and are sold again. The profit



Photo: Port Elizabeth College

goes to the fund, which assists the Quad Para Association of South Africa. Staff in IT and at Victoria site, Russell Road Campus and Struandale

Campus have been informed to collect and forward all used cartridges to a designated collection point.

Umfolozzi College: Recycling of paper

At Chief Albert Luthuli Campus of Umfolozzi College office paper is collected and sent to a local training



Boxes for collecting paper |

centre for students with physical and learning disabilities. There the students develop motor skills by separating paper from other items such as plastic before sending

off to recycling. The green team at the campus decided to send the paper first to the training centre because of the human aspect and also to do our bit for the community.

3.2.2 Green Curriculum

Characteristics

System expertise and shaping skills as well as the capability and willingness to take on producer responsibility are measurably promoted as objectives of education and training programmes. Needs of the economy and requirements of Education for Sustainable Development (ESD) are systematically taken into account in the development, implementation, and further development of education and training programmes.

To meet upcoming skills for green or greening jobs greening TVET institutions integrate green skills requirements into existing courses (e.g. green basic skills). If required, new courses oriented to green skills needs have to be designed (e.g. with focus on energy and resource efficiency and/or renewable energies). Greening TVET institutions are also used as learning laboratories by means of adequate equipment which enhances explorative learning. The capacity of teachers and instructors has to be developed to enable them to provide these kinds of training.

Examples

Eastcape Midlands College: Training in renewable energies in a green energy training workshop



Photo: Eastcape Midlands College

At Brickfields Campus, training in respect to indirect solar water heating is provided within the BEAT programme. A training module is used in the classes and the

lecturer teaches the concept and how it works so that the students become familiar with the technology. Besides this training module students can see a solar water heating system in practice, because a direct gravity feed geyser has been installed to supply the bathrooms, kitchens and so forth mainly on Brickfield Road campus.

In addition to those programmes, PV installations and wind energy are planned. In order to do this more professionally, a new green energy training workshop is under construction. It is in the process of completion and shall contain all training equipment needed. Electricity gained by PV modules and

wind turbines will be fed into the grid. All technologies will be used as training models because all the metering will be inside the new green energy training workshop. The lecturer was trained in GIZ's *Renewable Energy Technology Training* programme.



Photo: Eastcape Midlands College

The initiative was started by the Dean of Occupational Training and a lecturer. Funding has been made possible by the EWSETA and they planned to im-

plement the programme with the funds which were made available to the college. It is expected to generate at least 85000 kilowatts per year, generating 8.5 kilowatt from the 20 panels which will be installed. The return on investment would be at least 12 years.

Northlink College: Solar thermal installation and maintenance course



Photo: Northlink College

In order to assist unemployed youth in finding jobs in green industries, the college is providing a solar thermal installation and maintenance course at Belhar Cam-

pus. After identifying the project, two lecturers have been sent on training for the solar thermal course (train the trainer). Course material is available but additional material will be added to create a manual and learning material. Northlink is accredited to offer the thermal course as part of the plumbing course.

Northlink College: Solar thermal installation and maintenance course



Photo: Northlink College

Northlink College sees photovoltaic as a natural add-on to their electrical courses. It will/has also become part of the National Technical Vocational (NCV) cur-

riculum. In order to provide the course a lecturer, Mr Ronald Barnard, has been trained within the *Renewable Energy Technology Training* programme. A venue has been partially built in the electrical

workshop to offer the course (a second mezzanine floor was constructed for this purpose). All theory/practical training activities will be on the Belhar Campus; all on-site training will be conducted on all campuses. The activities are still in process and are proceeding steadily.

3.2.3 Green Research

Characteristics

Externally, research interventions done in cooperation with universities, other research institutes and industry, e.g. in the areas renewable energy (solar heating and cooling, PV), energy and resource efficiency (efficient lighting systems, waste management) and green innovations, serves the purpose of bridging campus-wide initiatives to respond to the needs of industry and community. Internally, it supports the scientific and technical basis for undertaking day-to-day campus-wide green initiatives and undertaking scientific research ventures, e.g. by testing and comparing performance and efficiency of different types of solar systems etc.

Examples

Central Johannesburg College: Constructing a dome shaped building for low cost housing

In cooperation with Wits University, the Central Johannesburg College designed, constructed and evaluated a dome shaped building for low cost housing. The dome



Photo: Central Johannesburg College

shaped house was meant to enhance cooling instead of using air conditioning. On top of the roof there is a small space where natural light gets reflected inside. The outside wall of building is painted in a bright colour, whereas the inside is painted in a light colour. The reason: darker colours absorb heat more than lighter colours. The installation of photovoltaic cells around the dome enhances heating during winter. In the entire building shell sensors are integrated, especially to measure outside and inside temperature.

Eastcape Midlands College: Installation and calculation of LED lighting

Reduction of energy consumption has a double effect: saving costs and decreasing environmental impacts. Lecturers for electrical engineering of Park Avenue Campus conducted studies on the different types of LED fittings and which ones were suitable for the different areas, also keeping in mind to conform with the legal luminance standards in each area. They chose appropriate LED lighting for the different purposes and installed them not only on their campus but also on Charles

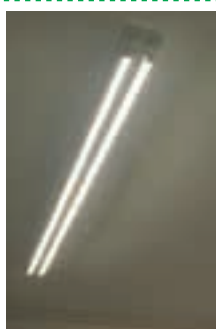


Photo: Eastcape Midlands College

Goodyear Campus. The fitting is exactly the same. Replacement is very simple: The conventional tubes are taken out and replaced by the new ones. LED lights are available in South Africa, but they are more expensive than conventional tubes.

The LED type light fittings seems to be a good substitute for conventional light-

ing as their luminance is not inferior; they save up to 80% of electricity, however price-wise at this stage they are more expensive.

Within an energy audit the following calculation was made:

- Cost of installing energy saving bulbs inclusive of labour: R 344700.00
- Rebate from Eskom: R 57346.47
- Cost: R 287353.53
- After 2.8 years there is a saving of R 100,000 per year.

3.2.4 Green Community

Characteristics

Greening TVET institutions see themselves as a nucleus of greening and strategic partner for the sustainable development of their region. Through local, regional and supra-regional partnerships they build on their skills and make them available to their municipalities, the local economy and other regional stakeholder groups.

Greening TVET institutions extend their activities and practices to the community level and participate actively in the sustainable development of their communities e.g. by offering formal and / or

informal training (installation of solar heaters, establishment of a waste management system etc.), supporting projects to solve local problems (installation of PV based lighting systems, improvement of water supply and/ or waste water management) and providing training courses for local industry concerning green issues.

Greening TVET institutions join with others to form a network. They use the network for exchange of knowledge and experience, as well as for gaining other TVET institutions for alignment alongside principles of greening.

Example

Boland College: Stellenbosch campus involved in "Plant a tree" initiative

NCV Life Orientation (skills) Level2 curriculum spells



Photo: Boland College

out that the students must get involved in a community project. A wide range of activities come to mind. The fundamentals faculty of Stellenbosch campus specifically

decided to execute this task by going to the local primary school to plant trees. A group of students accompanied by their teacher and representatives of campus and faculty management went to St Idas primary school and planted several trees. Now it is up to the school to take good care of them.

3.2.5 Green Culture

Characteristics

Greening TVET institutions provide an exemplary space for living and learning. They have a value orientation which embodies reciprocal respect, esteem, acceptance of responsibility, provision of a healthy workplace and promotion of maintaining health among the teachers. Greening TVET institutions take the concept of participation seriously. They promote individual responsibility of staff members and apply the concept of participation to teachers, students and administrative staff by connecting top-down and bottom-up approaches.

Even if the original initiative on greening comes from individuals, a systematic greening of TVET institutions cannot be done by a small group of committed individuals alone. It can only occur if all relevant stakeholders are informed about - and involved in the greening process.

Staff and students can significantly contribute to greening the TVET institution, e.g. by efficient consumption of energy and other resources, because they know their workplace best or have to learn what to consider respectively. Only when actively involved in the greening strategies of the TVET institution and when sensitised to, motivated and qualified for greening their workplace, training workshop, office etc. they can detect improvement potentials and shortcomings and eliminate these at an early stage.

Experience shows that ultimately those institutions that focus on the involvement of their staff into the framework of an implemented company and leadership culture have the most motivated staff. This way, creativity and competence of the employees can be used for an advancement of greening, and create an acceptance of this topic. Moreover, it appears that a constant and systematic course of action yields a more lasting effect than singular, spectacular campaigns.

Example

Boland College: Students at Paarl Campus involved in green week festivity

Mr Iwan Hartman, campus manager of Paarl campus, and his colleagues were wondering: How can student's environmental awareness be improved? How can attitudes and behaviour toward their immediate environment be changed? It was clear from the beginning that the answer could not be found in regulations or instructions. Their idea: organising a green week festivity with lots of games and space to challenge creativity and team spirit.

At the beginning of the green week students from different programmes at Paarl campus were required to choose a "green" theme to send positive



Photo: Boland College

green messages to the entire campus. They selected everything from recycling, prevention of pollution, to saving water, saving electricity, etc. Students could

choose any method to convey their message, be it drama, song and dance, fashion shows, posters or others. The different groups of students were competing with one another and the winning team would win different prizes. Some of the prizes were cinema tickets, McDonald's vouchers, Boland College paraphernalia, etc.

The green week was executed magnificently. The students really worked hard and had lots of fun while participating in these activities. The organisers were sure: the general attitude towards the environment has certainly improved.

3.2.6 Management Integration

Characteristics

Greening TVET institutions is a leadership task. It is born by the school management and is anchored in the organisation by attributing official responsibility and personal responsibility. Greening TVET institutions have a school-specific green profile, codified into the organisational mission statement. They have developed strategic development goals, which are carried out and put into practice within defined processes and through strategic projects. Responsibilities and accountabilities are fixed on all levels of management, staff (both technical and administrative) and students. Greening is a part of the school's integrated quality management. As continually developing teaching and learning sites, green TVET institutions regularly and systematically assess the results of their activities. They evaluate the results and deduct consequences for future action, in the spirit of on-going improvement.

Examples

Boland College: Development of an environmental policy

One of the first steps after the green team has been established and started working was to develop an environmental policy. This seemed to be necessary because there was passion and will to get the college as green as possible, but there was a lack of guiding documentation. The environmental policy should create a structure and a guiding document in line with the general Boland College's vision and mission statement to effect proper implementation of the green initiative. The policy was developed by the Quality Management Office with input from the project manager and other members of the green team. In developing this document the team also received kind assistance from Blackburn College in the UK. The policy was signed by the Principal and is now available on the college intranet.

"Developing this document was vital before the implementation of the green project", said Mr Kabedi Mpopote, project manager for greening at Boland College. "The availability of such a document is very instrumental in ensuring a guided and more structured approach when such a project is implemented. The document is endorsed by the Principal of the college therefore it comes with a lot of authority that somewhat binds the whole institution to abide by what is enshrined in it."

Environmental Management and Sustainability Policy of Boland College (extracts)

Scope of the policy

The policy is applicable to all students and employees of Boland College.

Purpose of the policy

The purpose of the policy is to establish guidelines for minimising the environmental impact of the activities within Boland College through supporting sound principles and implementing good practice, and by continuous improvement in environmental performance. The College will seek to develop an ethos of environmental responsibility in all its staff and students as well as in the management of its assets.

The policy relates to strategic objective 6: Continuously improve sustainable environmental performance in the College community

Objectives of the policy

The objectives of this policy are to:

- Improve the efficient use of natural resources
- Reduce pollution
- Develop and implement measures for recycling
- Educate and train staff and students to act responsible towards the environment
- Networking and establishing partnerships with "green" companies

- Develop innovative measures for the protection of the environment
- Provide a framework for the setting and reviewing of environmental objectives
- Create conditions that will allow the achievements of these objectives by means of continual monitoring, evaluation and improvement of existing policies, processes and procedures
- Comply with the requirements of ISO 14001 and relevant legislation.

To achieve these objectives, the College will plan to:

- Improve communication between all sections of the College community (students and staff), in order to promote shared responsibility for the environment.
- Improve the quality of life on the campuses and head office through encouraging appropriate and considerate behaviour in relation to litter and anti-social behaviour.
- Train staff on sustainability issues and covering policy and practice in staff induction.
- Reduce water usage through wise use and implementing conservation measures.
- Minimise waste through reduced consumption, minimising waste and the adoption of efficient waste management and recycling methods.
- Develop targets for a reduction in energy use including the adoption of conservation measures and renewable energy sources.
- Adopting best practice in new build and refurbishment projects.
- A commitment to the wise choice of products and suppliers and using sustainable procurement processes.
- Adopting contingencies to reduce the environmental impact of transport / travel and to improve accessibility for all.

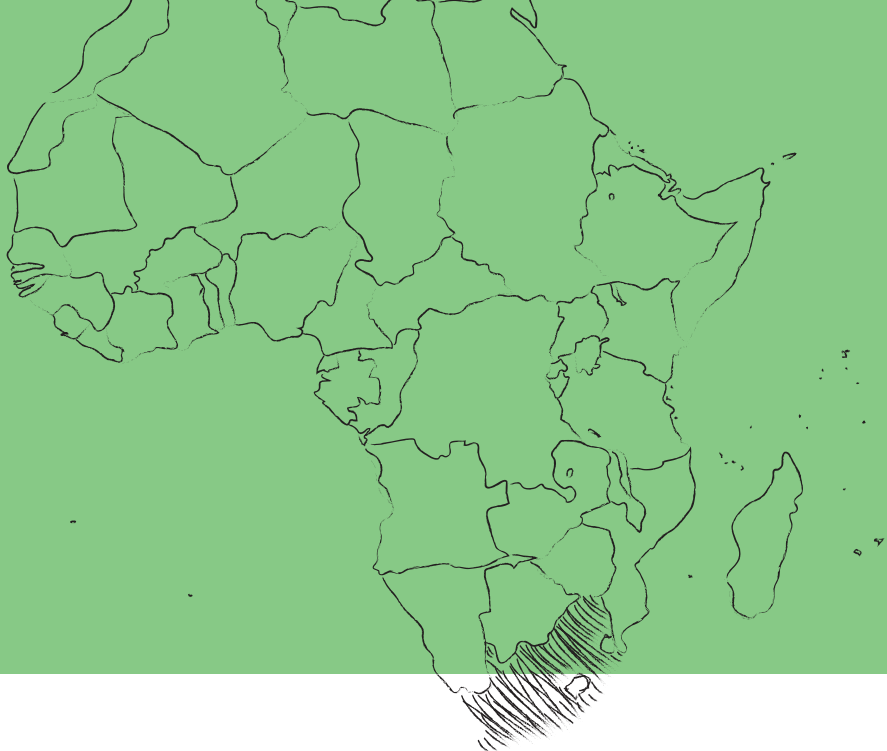
Boland College: Training on ISO 14001



At the end of training every participant received a certificate.
Photo: Boland College

In order to introduce the concept and requirements of the ISO standard for environmental management systems and to make sure that at least the green team is knowledgeable of the standard, training on ISO 14001:2004 was conducted on 3rd to 4th December 2013 at the head office. Additionally to the members of the green team, some

staff members from different campuses were included, because they were earmarked to play an important role when the project is rolled-out to their specific campuses. The knowledge gained from the training propelled the green team to pursue an official environmental audit. The latter has been commissioned and will be conducted in the second half of 2014.



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Contact

Boland College

85 Bird Street
Private Bag X5068
Stellenbosch, 7599
Internet: <http://www.bolandcollege.com/>

Contact

Mr Kabedi Mpopote
Programme Manager: Education and Training (Performance Monitoring and Evaluation)
Email: kabedim@bolandcollege.com

Central Johannesburg College

5 Ubla Avenue
(Off Princess of Wales Terrace)
Parktown
Johannesburg
Internet: <http://www.cjc.edu.za/>

Contact

Mr Adam Taumang (Project manager)
Ellis-Park campus
Email: taumanga@cjc.edu.za
Ms Gloria Tshabalala (Team leader)
Highveld campus
Email: gloria.tshabalala80@gmail.com
Mr Themba Mazibuko (Team leader)
Centre of Employment and Enterprise Development (CEED)
Email: themazibuko@gmail.com

Eastcape Midlands College

Private Bag X35
Uitenhage, 6230
Internet: <http://www.emcol.co.za>

Contact

Mr Ziyaad Smith
Project Manager Greening / Quality Assurance Department
Email: ziyaad@emcol.co.za

Goldfields College

36 Buren Street
Flamingo Park
Welkom
Internet: <http://gfc.za.net/GFET/>

Contact

Mr Rachere Radile
Campus Manager
dobsradile@gfc.edu.za
Mr Maruping Marumo
Campus Manager
marumo@gfc.edu.za

Lovedale Public TVET College

1 Amatola Row
King William's Town
<http://www.lovedalecollege.co.za>

Contact

Ms Nanette Lötter
Manager: Partnerships and Skills Unit
Email: lotter@lovedale.org.za

Northlink College

80 Voortrekker Road
Bellville 7530
Internet: <http://www.northlink.co.za>

Contact

Mr Terence Slade
Physical Resources Manager
Email: tslade@northlink.co.za
Mr Heinrich Snyders
HOD Engineering Studies
Email: hsnyders@northlink.co.za

Northern Cape Rural TVET College

6 Morant Street
Upington 8800
Internet: <http://www.ncrfet.co.za>

Contact

Ms Raquel Marinus
Special Projects
Email: raquelm@sp.ncrfet.co.za

Port Elizabeth College

139 Russell Rd
Port Elizabeth 6001
Internet: <http://www.pecollege.edu.za/>

Contact

Ms Sonja Spies
Head of department
Email: sonjas@pec.edu.za

Umfolozi College

Off the R102
Chief Albert Luthuli Campus
Groutville
Internet: <http://www.umfolozicollege.co.za/>

Contact

Ms Sheritha Singh
Lecturer
Business Department
Email: sher.singhzn@gmail.com
Ms Nondumiso Mbatha
Student Support Services
Email: nqobile.mbatha@gmail.com

Annex: Greening TVET institutions in Germany

Introduction

If TVET is given a key role in the context of green economy and sustainable development, then TVET institutions will be faced with extensive demands. It is at the micro level of training programmes that the principles and concepts of sustainability developed at the macro level of TVET would be manifested. Here, through practice, it would become evident which competences have to be promoted and trained among young people on initial training, but also among older people on further training level in order for them to be able to make professional contributions to societal transformation – or not. Sustainable development, environmental and resource protection would become the core focus of qualifying vocational schools. It would become much more than an add-on, temporary issues which are left to isolated committed teachers and trainers or which are only given attention on the periphery through individual projects.

Even though the greening of TVET institutions has been discussed in Germany for more than 20 years already, there are hardly any TVET institutions which fulfil to any extent the criteria of the green TVET institution's approach, as a total concept. However, there are numerous examples which do cover several aspects of the concept and could serve as role models.

In the following you will find examples of greening activities in German TVET institutions (vocational colleges and – in one case – a training company) in regard to the six key elements of the greening TVET institutions approach. Following this, two vocational colleges with special green profiles are introduced. This includes interviews with representatives of both colleges in which they explain their concepts, procedures and experiences.

Green campus: Greening the campus systematically ²

The Johannes-Gutenberg-Schule (JGS) in Heidelberg is a vocational college with 100 teachers and 2,000 students. Its focus is on occupations in the crafts, industry and agricultural sector. Since 1998 the JGS is active in the fields of renewable energies and sustainable development by means of student's projects. The college has implemented an environmental management system (EMS) and sees itself as a multiplier for eco-friendly and responsible behaviour.

Within the framework of the EMS the vocational college assessed its environmental aspects and tries to minimise its environmental impacts systematically.

Among others the following objectives have been achieved:

- **Waste:** The waste concept consists of two containers placed in the corridors. In addition there are crates for collecting paper. These were non-ambiguously labelled “paper“, which considerably reduced the number of missed throws. There is a residual waste container in each classroom. Harmful waste produced in school is collected in a special container. This also means disused fluorescent tubes, flat batteries and electronic scrap. The disposal is done by the municipality of Heidelberg and certified subcontractors.
- **Energy:** Students and teacher are periodically informed about the possibilities of saving energy. PC rooms have been subsequently

² Johannes-Gutenberg-Schule Heidelberg; 2012: Umwelterklärung 2012. Heidelberg. Online: http://www.jgs-heidelberg.de/resources/pdf/emas/umwelterklaerung_2012.pdf [Access: 18-03-2014]

equipped with key locks in order to further reduce the energy loss by standby-mode.



Different waste bins for packages and garbage
Photo: K.D. Mertineit

Stickers and posters give information about energy saving opportunities. Ceiling-lamps in classrooms and workshops can be switched separately. A big photovoltaic system has been installed on the roof.

- **Paper:** In copier rooms, classrooms and the registry we have placed plastic containers to collect waste paper in order to separate clean waste paper for recycling. Digital media and both-sided copying using the downsizing-option should help to cut paper consumption.
- **Heat:** Common radiator-valves are being replaced by thermostats.

Green curriculum: Full-time vocational school “Renewable Energy Technology”³

New requirements in the fields of energy efficiency and the production of renewable energy have changed the core work patterns in, e.g. construction, metal, electric and sanitary, heating and air conditioning professions. A craft encompassing way of thinking and acting, and an adequately developed consulting competence are gaining importance more and more for the quality of craft work. In 2012, the vocational college of Osterholz-Scharmbeck introduced a one-year full-time vocational school for mechatronics focusing on “renewable energy technology” in order to meet these new demands. The full-time vocational school conveys expertise in handling renewable energy technologies to lower and middle secondary school graduates – skills that are demanded by local companies.

Besides the elementary education in metal and electric technology they emphasise solar energy production (focus: photovoltaic and solar thermal). In addition to the practical and theoretical tuition the students run through at least one company training for several weeks in one of the local crafts companies.

This training programme has been implemented successfully in the meantime. The first year could offer a most attractive programme in cooperation with regional and local energy suppliers, supported by regional craft companies, by the motivated work of the teaching staff and – not least – by the positive students’ acceptance:

- The existing photovoltaic installation on the roof of the school was expanded.
- The demonstration model „sun-tracking solar installation“ was developed and produced as a prototype.
- The cooperation partners gave lessons in class (lectures, thermo graphics in school) and facilitated excursions to renewable energy installations in the region.



Students installing a PV system (Photo: D. Kunstmann)

- The students showed a strong learning interest and dealt with the significance of responsible and sustainable action at work.
- The new full-time vocational school offers a technical elementary education as an approach into a dual vocational education in electric, metal and sanitary, heating and air conditioning technology professions.

The project has been established well within the school and was continued in the subsequent school year. The strong number of applicants suggests a high acceptance among the student.

Green research: Training for a sustainable regional energy supply ⁴

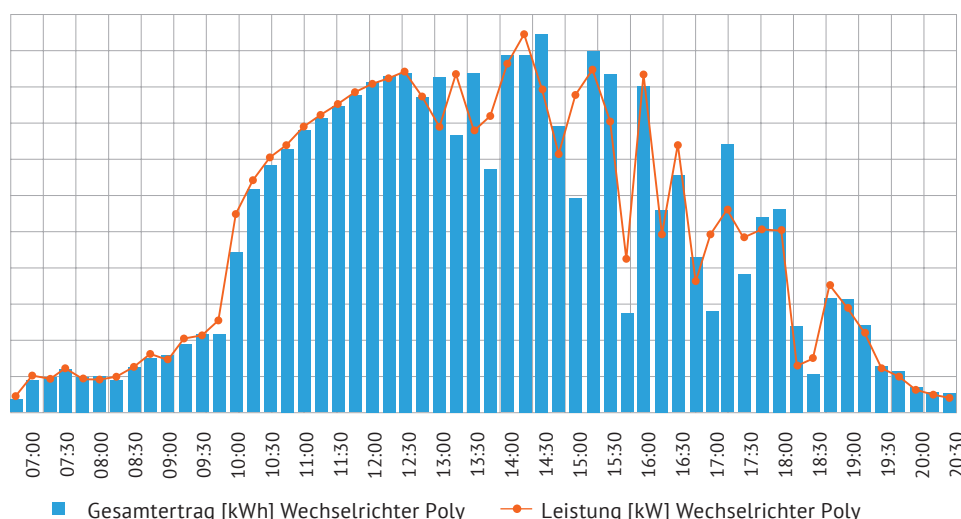
The BBS II [Vocational College II] of the city of Delmenhorst has set the objective to sensitise as many students as possible for the issue sustainability and to enable them to participate in the creation of society and the working environment with ecological, economic and social responsibility. Doing so, the students should take over responsibility as consumers and producers even-handedly. In the project the college's already existing photovoltaic installation was expanded. This expansion was planned, implemented, documented and evaluated within the framework of a students' project. Special attention was turned to the application of innovative thin-film-modules.

Learning situations were being developed in the course of the project comprising not only technical aspects but equally economical, ecological and social dimensions. Moreover the performance data of the photovoltaic installation were documented and published in the internet. This offers on the one hand an opportunity for all craft companies to observe a real installation and on the other hand interested vocational colleges can integrate the data

into their teaching projects. The installation and its energy policy context is again a topic of the subject "solar energy" being offered within the political education for all classes in all types of education in the college.

These newly developed learning situations were exemplified with apprentices of the electronics technicians' career specializing in energy and building technology. In total 73 apprentices were involved. The solar installations were applied in the four years of apprenticeship focusing on different issues. The emphasis was in the learning field 11 »Installation, launching and maintenance of energy installations« (third year of apprenticeship).

Learning at the client's order facilitates an open-structured and flexible processing of the task in the sense of complete action. Besides technical expertise a special attention is turned to methodological, social and personal competences. The co-design of relevant business- and work-processes as well as the society itself requires personal competences (decision-making abilities, assertiveness, self-motivation etc.) and social competences (teamwork capacity and conflict handling skills). Moreover technical competences (contents and expertise) and methods competences (research, presentation, conversation with clients, handling of planning software etc.) were strengthened.



Performance data of a photovoltaic plant from May 23, 2012 (source: BBS II Delmenhorst)

⁴ http://www.bbs-futur.de/de/Projekte/pdf/BBS2Delmenhorst_PV.pdf [Access: 18-03-2014]

Training for a sustainable regional energy supply includes the testing and evaluation of alternatives to the existing energy supply system in Germany, dominated by fossil and nuclear energy sources. For that purpose the students have carried out measurements and experiments, planned installations and calculated the anticipated output. Advantages and handicaps of technologies were recognised and assessed.

The project contributes to the »Energy Transition« by conveying expertise to prospective specialists not only to install these technologies but also to assess them in terms of sustainability (covering the dimensions ecology, economy and social responsibility) and to give advice to clients. In excess of the production of renewable energy, the exploitation of raw materials, viz. rare earth metals, copper, and the disposal of photovoltaic modules (PV recycling) are most important education issues. These were simultaneously taught in political education.

Green community: Apprentices take on sponsorship for a local creek ⁵

The Koehler Group, a family-run company, produces over 500,000 tons of specialised paper and cardboard annually and sells them all around the world. The company is well aware that its activities affect the environment. The effective use of natural raw materials, and the protection and management of the environment, are seen as pre requisites for the company and its staff for sustainable economic growth and the well-being of people and society. It is an inherent part of the company education to carry out at least one environmental protection project per year; including the creek sponsorship being actively practiced since 1997.

About 30 years ago creek called „Weidenbach“ was redirected in the course of a land consolidation

project. The new bed of the creek was deepened in order to prevent flooding. Piles of rocks were used as bank reinforcements, which deprived the creek of any expansion possibility. Following plantations at the banks of the creek were patchy. Incited by the responsible regional administration, apprentices and employees of the company have taken care of a 1.4 km-section of the creek since 1997. They took the municipal surface waters development plan of the municipality of Oberkirch as a guideline. Every single action is - in advance - being coordinated with the local environmental organisations and the environmental representative of the municipality of Oberkirch.



Apprentices remove invasive plants | Photo: Koehler group

Objectives of the creek sponsorship:

- acceptance of responsibility,
- promotion of plant- and animal-diversity in and around the water, amongst others the resettlement of the river kingfisher,
- natural bank reinforcement by domestic woods in accordance with the location,
- reduction of the effort necessary for the maintenance of the watercourse,
- raising the awareness among apprentices and employees of possible consequences of water contamination.

Measures taken (inter alia):

- groom woods and start new plantations,
- fight invasive plants,
- flatten too steep bank slopes,
- clean creek,
- produce, suspend, clean and maintain birdhouses,
- document and evaluate birdhouse occupancies,
- produce and install bridges,
- eliminate storm damages,

⁵ See Koehler Paper Group; 2014: Company Information 2013. Oberkirch. Online: http://www.koehlerpaper.com/media/docs/en/company/Firmenbroschure-2013_GB.pdf [Access: 18-03-2014]; <http://www.koehlerpaper.com/en/unternehmen/umwelt/> [Access: 18-03-2014]; <http://www.koehlerpaper.com/en/unternehmen/umwelt/meldungen/40-Helfer-im-Einsatz.php> [Access: 18-03-2014]; <http://www.koehlerpaper.com/de/unternehmen/umwelt/meldungen/Koehler-unterstuetzt-bekaempfung-des-japanischen-Stauden-Knoeterichs.php> [Access: 18-03-2014]

- remove obstacle for fish migration by constructing a fish pass,
- lead guided tours to pass on information.

Green culture: Future lab for the design of a patio ⁶

At the time of the described example the training centre of the Salzgitter Group, trained about 550 apprentices in eight technical and commercial vocations. The training management's reflections about the redesign of the training centre's patio formed the point of departure. As many apprentices as possible should be involved in the design- and the following reshaping procedures. A future lab should serve as a kick-off.

This future lab's objective was to collect ideas for the prospected redesign of the patio and to sensitise the apprentices for the requirements of environmental protection. In addition, awareness for horticultural questions and subjects should be created among the participants and they should be motivated to participate actively in future construction- and plantation-projects by personal contributions. The future lab was held during four days involving 14 apprentices from commercial professions.

After a detailed address of welcome by the host and a round of introductions, the future lab's objectives and attributes were introduced. Moreover, its schedule was presented, as well as anticipated results and the final presentation procedure was drafted.

This was followed by an introduction by the host into the objectives and procedure of the phase of criticism. The participants formed four groups and discussed their opinions about the patio's deficiencies and what should be improved in the first place. The points of criticism were documented on pin board cards. The individual participants presented their points of criticism and pinned the cards to a prepared board. On the board they were sorted according to their topics resulting into nine key aspects.

The participants were led into the phase of imagination by means of a narration. Afterwards, divid-

ed in groups, they got the task to develop ideas as creative and fanciful as possible how the patio can best be incorporated into education without being affected by feasibility considerations. In the course of presentation and discussion of the imagination-phase's results the key question emerged: What are the connecting factors for realisation short-term, medium-term and in the long run? Then the participants assessed the projected visions and their individual aspects of apparent feasibility.

In the phase of implementation the participants allocated themselves to selected visionary concepts for further development and work out feasible proposals for their implementation into education.

Objectives, procedure and results of the future lab were finally presented to the instructors, the education manager and the company's educational expert.

The following four project proposals were developed as a result of the future lab:

- **Drawing:** Relax in lounge corners within the green patio with additional basking-lawns for summertime;



The four architectural proposals submitted within the framework of the future lab by the apprentices
Photo: R. Voges

- **Model:** Green patio with box tree lawn beets in "Rural Garden Style";
- **PowerPoint-Presentation:** Clearly laid-out patio with self-made seating-elements from our own workshop;
- **Computer graphics (by digital camera):** Utilisation of the entire space of the patio as a "sun lounge" including sitting chair groups and potted plants arranged around the PPS-logo.

⁶ See Mertineit, K.-D. / Exner, V.; 2003: Berufsbildung für eine nachhaltige Entwicklung. München.

The architectural proposals submitted by the apprentices were presented to the public on the occasion of an open house event in a partner school and

afterwards for one month in the lobby of the education centre to the staff and the other apprentices where they drew much interest.

The future lab found so much approval that further future labs for similar projects are scheduled.

Management integration: Greening in the framework of an environmental management system ⁷

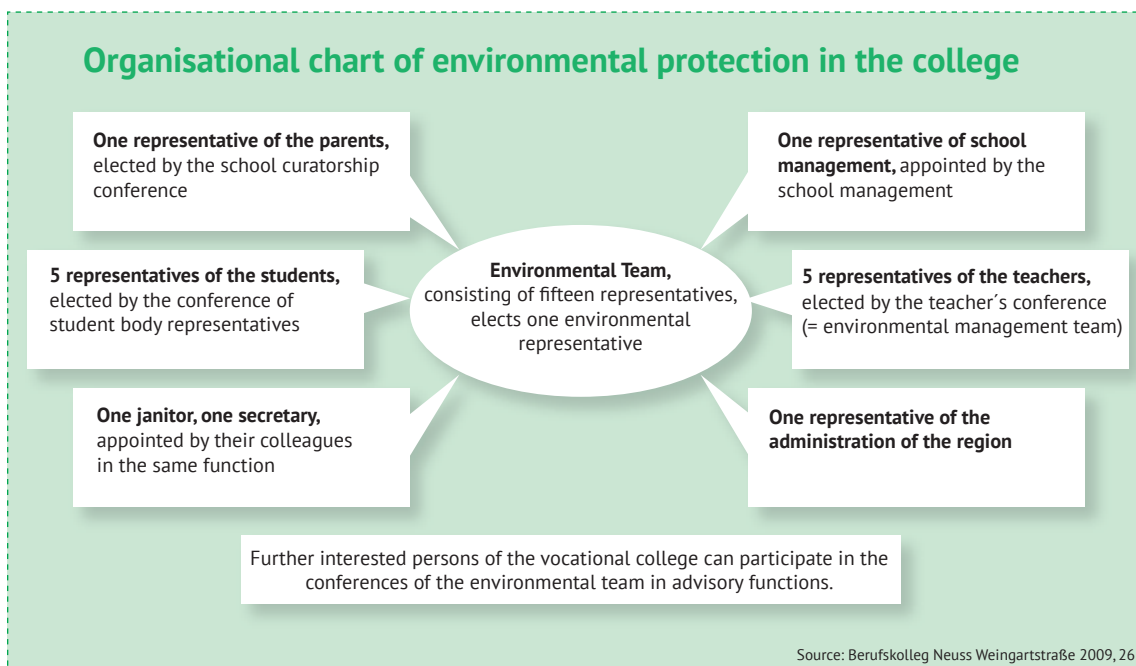
The Vocational College Neuss Weingartstraße is focused on economy and informatics. Roundabout 140 teachers teach 3,000 pupils in training courses within the dual training system (part-time) or in full-time vocational school courses. Since 1998 the college is focusing on environmental protection and education. Many different activities have been done in this field to improve the environmental performance of the college and to integrate environmental issues into courses. Among others, an environmental management system (EMS) according to the European standard EMAS (Eco Management and Audit Scheme) has been developed and first validated in 2000. Since then the EMS has been re-validated every three years, and since 2006 the

college is also certificated according to ISO 14001. Starting with the eco-audit process in 1998 the Vocational College has established an environmental management system and has upgraded ever since. The whole environmental management system, the build-up and process organisation, the protagonists and their tasks and responsibilities are described in detail in the environmental management manual.

The constant improvement of environmental protection in school is the objective of the management system, which is under special attention of the active cooperation and inclusion of all persons involved in school.

The environmental team as a central consulting board for all school-relevant environmental questions and activities is in the focus of the project. On the semi-annual conferences of the environmental team the members are being informed about recent projects and activities. The members submit their own contributions to environmental protection in college, and make decisions and discuss environmental matters.

The environmental team is formed as shown in the graph:



⁷ See Berufskolleg Neuss Weingartstraße; 2009: Umwelt-
erklärung 2009. Neuss. Online: http://www.umweltschulen.de/audit/neuss/ue/UE_2009.pdf [Access: 18-03-2014]

The chairman of the environmental team is the environmental representative, supported by the environmental management team. They concertedly control the eco-audit process and the environmental management system. The environmental representative is supported by the representative for hazardous materials and the representative for safety, cooperating in terms of safety.

The employees of the vocational college (janitor and secretaries) are being actively included in the work of the environmental representative, because they are significantly involved in environmentally relevant processes.

The management representative safeguards the in-

formation flow to and from the principal's staff. Moreover, he/she will further develop the environmental management system and promote environmental awareness on all levels of the school.

The students form a crucial element in implementing the system. In the vocational college we offer two commercial vocational careers including specialisation programmes for „environmental management“, in which the teaching is project-oriented and carried out in team-teaching. Students in these vocational education programmes work as entire classes or in teams participating in ecological focus-tasks and measures within the framework of the school environmental management.

Greening TVET institutions based on a holistic approach

The Vocational and Technician College Butzbach

The Vocational and Technician College Butzbach at a glance

The Vocational and Technician College Butzbach is located in a rural area approximately 50 km north of Frankfurt. There are 55 teachers responsible to educate roundabout 1000 students. 500 students are educated in the field of initial vocational education and training (full-time vocational school within the German dual training system as well as full-time vocational school) and vocational preparation. Vocational education and training courses are provided in the fields of automation & mechanical engineering, energy & environment, nutrition & catering trade, electrical engineering and media & design. Another 500 students are educated in the technician college (further education and training) to become a state-recognised technician in one of the following fields: food technology, mechanical engineering or conservation technology.

Since the mid-1990s the Vocational and Technician College Butzbach has set an emphasis on environmental protection, and the college is known nationwide for its competence in green technologies. Green issues are integrated into the school's mission statement and vocational education and training courses as well as into the design of buildings and demonstrated on the school ground.

There is also a close cooperation with local industry. On the one hand students of the assistance classes are partly trained in companies in terms of



internships. On the other hand students of the technician college get real tasks for project work from companies and they present their results regularly to representatives of local industry.

Green issues in the mission statement

Extract from the school's ecological guiding principles:

Our school is dedicated to the demands of Agenda 21. This is why raising ecological awareness is the main objective of our pedagogical work.

Simultaneously the process of opening up the school to the outside is another crucial objective. By doing this the school is integrated into the social life of the region. The school communicates with its

regional stakeholders and meets the demands of society. This covers ecological issues, especially in the field of energy and society.

By working on projects - school-type and interdisciplinary teachings with ecological contents - the environmental awareness of teachers and students shall be internalised and individual autonomy shall be enhanced to a point that ecologically sensitive behaviour will shape actions in day-to-day school life as well as social and private life.

As a vocational school we take on responsibility for a qualified, future and market-oriented education and training. In future the pedagogical work shall be designed in a way that the development towards ecological thinking and behaviour is seen as a process and hereby is constantly being evaluated.

The constant adaptation to the ecological requirements shall contribute to a sustainable development, required by the Agenda 21.

It is most important for the teaching staff to consider themselves as role models, and that necessary competences will be acquired by modern, practise-oriented teaching.

Our students shall be taught by not only developing a high environmental awareness and conflict-solving competence, but also feel firmly bound to the principles of humanity in order to show teamwork capacity.

Green issues in vocational education and training courses

A main focus area of the Vocational and Technician School Butzbach is renewable energy, energy efficiency and energy management. Among others these issues are an explicit topic of special training courses in the full-time vocational school as well as Technician College.

On initial training level a two years full-time vocational school course on "Assistant on Solar Thermal and Photovoltaic" is provided. The class is for young people with intermediate school certificate and offers not only a vocational qualification, but also the entry qualification for entering university of applied sciences and arts.

In the first year of learning the participants are educated in the school three days a week; the other two days they are trained in company within an internship. There is another four-week internship at the end of the first year of learning. In contrast the whole second year takes place at school.

The students are educated in learning fields and learn how to install, start-up, repair and maintain solar thermal and photovoltaic systems as well as combined heat and power units.

In the technician college students are educated in a two-year full-time vocational school to become state recognised technicians, e.g. for conservation technologies. Precondition to enter this course is either a certificate as a skilled worker in the field of metal processing, electrical engineering or chimney sweeper or at least five years of work in one of these occupational fields.

The main topics are:

- energy saving / energy consulting,
- energy efficient heating and ventilation systems (e.g. heating technology, air-conditioning and ventilation technology, combined heat and power units, energy management),
- and renewable energies (photovoltaic, solar thermal, biomass, wind energy).

The course is divided into six learning fields. Additionally, 200 hours of project work is part of the curriculum. In the project work the students work in teams on real tasks coming either from companies or the school.

Green issues in the buildings and on the school ground ⁸








Many green technologies are visible on the school grounds and/or integrated into the buildings, e.g. PV, solar heating, solar cooling, wind energy, and usage of rain water. As a consequence of having developed courses on the topics, viz. renewable energies, energy efficiency and conservation technologies, the college planned and implemented the construction of an ecologically-sound building with low energy consumption, which at the same time serves as an observation and experimentation object. The buildings are extendable. They are continuously being adapted to the current state of technology and serve as a place for the students to experiment and display models of changing green technologies.

Results of the technician's project works are used to demonstrate new green technologies in the

⁸ Source of all photos: Vocational and Technician College Butzbach.

school and to improve the school's environmental performance. On the other hand these technologies

are integrated into the training courses of assistants and technicians as learning objects.

			
<p>Low-energy house standard: One of the buildings achieves the national low energy standard. That means the energy consumption for heating is less than 50 kWh/m² per year.</p>	<p>Passive house standard: Another building achieves the national ultra-low energy standard. That means the energy consumption for heating is less than 15 kWh/m² per year.</p>	<p>Green roofs: The low-energy house is equipped with a green roof that helps to insulate the building. In summer it keeps the building cool and in winter warm.</p>	<p>Windows: There are different types of windows installed; some of them include seasonal protection against thermal radiation (in summer) or PV cells.</p>
			
<p>Walls: Different wall constructions are showcased in two of the school buildings; partly the walls are open, so that the different materials can easily be seen.</p>	<p>Demonstration of different insulation materials: Different insulation materials used in the buildings are showcased.</p>	<p>Open installations help to understand how and where supply lines are installed.</p>	

Green technologies (among others)



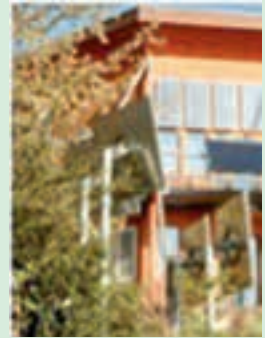
Rainwater utilisation system: Rainwater is collected, cleaned basically and used for sanitary.



Solar thermal cooling: A solar thermal cooling system has been designed and installed by technicians. It is now used as a demonstration object in training courses.



Wind power plants: There are different types of wind power plants on the school ground



PV systems: Different types of PV systems are installed on buildings and on the school ground as well as integrated in windows.



Solar thermal systems: Different types of solar water heating systems provide hot water.



Display: A big display in the lobby shows everybody the current weather conditions as well as the amount of electricity and hot water gained by the school's PV and solar thermal systems.



High efficient heating systems are demonstrated.



Electric vehicle: An electric car demonstrates an alternative to conventional cars.

Interview with Mr Jens Voss, Head of Environment and Energy Department of the Vocational and Technician College Butzbach

Mister Voss, the Vocational and Technician College Butzbach provides a range of vocational education and training programmes in the field of renewable energies and energy efficiency. What can students learn in these courses?

On the one hand, we have the full-time vocational school, the so called „assistant professions“, and we have technician courses, this is further education. We have to distinguish between these two courses. The full-time vocational school is about the basics of the installation of renewable energy systems. The participants learn how to install, maintain and launch these systems including all technical and theoretical backgrounds involved with it. The technician training is more diversified. Part of it is, the planning and configuration of technical installations that are affected by renewable energy, ventilation, air-conditioning and heating. Moreover, an important learning content within the technician's training is the cooperation of these various technologies as well as the integration of renewable energies in already existing energy supply systems.

Which opportunities do the graduates of your courses have on the labour market?

In general their chances are excellent, but we have to differentiate again. The assistant's career in most cases is a first step into professional life for very young people; many of them continue with an additional vocational or university training. This is why the chances in the labour market are difficult to estimate. The graduates in fact do have fair chances and many of them have found employment in companies for heating systems and electric installations. For the graduates of the technician courses the opportunities are excellent, depending in fact on which prior education the candidate had. Somebody coming from the specialisation as installation mechanic has very, very good chances to find employment as a technician in the fields of renewable energies or heating technology. Somebody having a less attuned pre-education, e.g. having worked before in environmental technology or sewage technology, may encounter some difficulties in finding an immediate employment.



How do you cooperate with the local economy?

The education for an assistant's career always comprises internships in companies. Therefore, we have strong connections to companies, because we constantly look for places for internships, which are in fact offered to us. The contact during the technician's training is mainly kept via the project-work. Every student has to prepare a project work in the course of the training and at this point we cooperate with companies from the region intensively.

One essential feature of your school is the fact that you exploit the building itself and the existing technology as leading objects. Moreover you offer the students the opportunity to find their own technical solutions and to install and test them in and on the building and school premises. Would you please illustrate that?

We have here, for example, a passive house that was launched about three years ago. A passive house should consume less than 15 kWh per m² and year. We have set-up a student group now on the following project task: Check if the passive house parameters are being kept to. Is the actual energy consumption really as low as required? If not, why not and what can we do about it? How can we manage to keep the actual energy consumption under 15 kWh per m² and year? Now the students have to come up with concepts to improve the efficiency of the ventilation. This is one of the possibilities how students can work directly on the building.

So the students develop proposals for solutions, which are directly being implemented in school. They develop solution proposals and these proposals can then be implemented. Sometimes this will take a while, because we cannot just restructure a building; the authorities still have a say in that. Up to a certain dimension we can do it directly. Bigger reconstructions, of course, need the involvement of the authorities.

How is that received by the students?

The students like it as long as it keeps moving and there is progress. In case of technical or administrative obstacles, they sometimes become dissatisfied. Their time here at school is limited and authorities usually need some time to make their decisions or give approval or allocate money.

This demands a lot of flexibility from the teachers. What's their attitude?

Flexibility among the teachers is not much of a problem. For teachers, it is more difficult to schedule the project work, because in this building there are also classes being held at the same time. On the other hand, the students working on projects need sufficient mentoring time, and the teachers' mentoring time must also fit into this

schedule. A very careful organisation is needed to provide the teachers with the necessary time and presence. This is the pretence that we have. From this point of view – I agree – that requires flexibility. Three, four or five colleagues are willing to fulfil this task and normally that's sufficient to supervise the projects.

Everything that can be seen in your college today didn't fall out of the sky but has grown over a long period of time. What were and still are your most important factors that have enabled this success?

The key factor was our former deputy director. Twenty years ago, he already had a vision, about what vocational education should be and which focus could suit the college. He was also very active in politics and a member of many political boards and bodies. Moreover, he was an outstanding organisational talent being able to bring together various spheres and exploit them for the college. He found ways to acquire the financial means that were necessary to achieve this. The next factor was the former deputy director's ability to find colleagues who were enthusiastic with this issue and invested much additional energy into this project to bring it on the road.

The Vocational College for Construction Occupations of the Hanover Region

The Vocational College for Construction Occupations of the Hanover Region at a glance



The Vocational College for Construction Occupations of the Hanover Region provides vocational education and training courses in regard to all occupations in the field of civil construction, from

brick layers to roofers, and from painters to carpenters.

Roundabout 110 teachers and 15 administrators take care of 2500 students in education and training courses in regard to 29 occupations within the German dual training system. Students not having a contract with a training-company are provided a vocational orientation in construction technology, wood technology and supply engineering in terms of full-time vocational school classes.

Extract from the school's mission statement:

Our vision

- The Vocational College for Construction Occupations of the Hanover Region aims at the utmost possible satisfaction among all stakeholders as client-oriented provider of vocational education training.

Our mission

- The Vocational College for Construction Occupations of the Hanover Region prepares its graduates for the working life by conveying a holistic vocational core competence and developing with them an orientation in the world of living.
- In cooperation with its partners it qualifies its students in becoming skilled for higher education courses.

Our promises

- In our school we create a living and working habitat in which they can optimise their personal and technical development.
- We offer companies the best educational support in regard to human resources.

development and technical qualification of staff.

- We qualify our students in a concise and optimal manner in order to meet the requirements of higher education institutes.
- The college offers a working atmosphere that is characterized by reliability, tolerance and open-mindedness, where everybody fulfils his/her respective tasks autonomously. The staff are offered work possibilities appropriate to individual qualification profiles as well as support in further development of talents.
- To its students the school conveys the basic qualifications necessary to participate in social life and to take on responsibility for sustainable development.

The Centre for Energy Efficient Civil Engineering & Building Technology⁹

Together with the neighbouring school the Vocational College for Construction Occupations of the Hanover Region operates the Centre for Energy Efficient Civil Engineering & Building Technology.



The development of the centre has been sponsored by the Federal State of Lower Saxony and the authority of Hanover region. In modern vocational education and training, topics like climate protection, energy efficiency, sustainability and resources conservation are in focus of various practical solutions. Apprentices in installation occupations in the fields of metal and electric engineering as well as in civil construction occupations execute educational projects covering topics like thermal

insulation, smart facility systems, alternative heating systems, controlled ventilation, ecological balances of products, recycling of construction waste, healthy construction materials and barrier-free living. The sensitisation for energy efficiency and the handling of innovative technology become an integral component of students' vocational competence.

Common reference is the construction, operation, maintenance and repair of energy efficient facilities. They are considered as a system, where various trades contribute their specific skills and knowledge. Seeing the bigger picture is hereby essential. The friction losses in collaboration of different trades are overcome. The overall objective is environmentally compatible construction in cooperation with others.

In the classrooms the students are being exposed to typical everyday situations, for which they have to develop solutions.

Experiments and measurements are being performed in the laboratories for electric, control technology and for supply engineering.

In three pavilions the learners can see, touch, test and analyse different construction standards. Various parameters (e.g. outside temperature) can be simulated and their impact can be quantified.

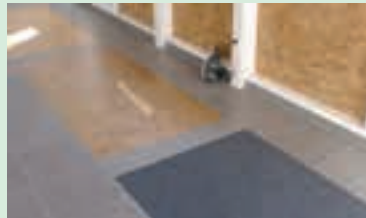
⁹ Source of all photos: Vocational College for Construction Occupations of the Hanover Region

Technical features

Construction technology



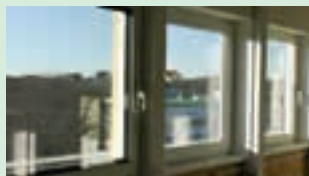
Walls: 27 different wall constructions are showcased; thermal transfers and humidity flows of every wall constructed is illustrated.



Floors: Three different floor constructions, vacuum insulation panels, under floor heating wet installed / dry installed with or without thermal insulation.



Roofs: There are three platform roof varieties – green roof, black, white, roof with insulation on rafters, insulation between rafters.



Windows: Windows with different u-values, with or without assembly failures.



Blower-Door-Test: Each pavilion is equipped with a test device for air-tightness.

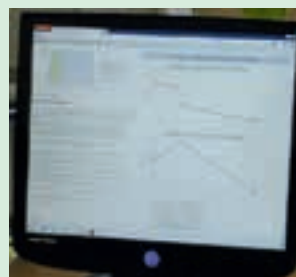


Infrared camera: Two infrared cameras in different resolutions for the demonstration of thermal bridges and contact free troubleshooting in electronic engineering.

Supply engineering



Solar thermal: Tube and flat collectors. *Photovoltaic:* Different kinds of PV systems. *Heat-pumps:* Measurement of complete energy balance, ice / latent heat storage, hybrid collectors



Heating: Comparison of the energy balances of the three pavilions.

Electrical engineering

		
<p>Building services engineering with KNX / EIB. Daylight depending lighting control Weather depending shutter control</p>	<p>Surveillance of doors and windows.</p>	<p>Programming of lighting scenarios.</p>
		
<p>Lighting booths with measurement of rates of reflections.</p>	<p>Demonstration of energy balances of different lightings.</p>	

Interview with Mr Ulrich Erdmann, Principal of Vocational College for Construction Occupations of Hanover Region

Mr Erdmann, you have established a Centre for Energy Efficient Civil Engineering & Building Technology at your college. What's it all about?

There are several issues at the core of our Centre for Energy Efficient Civil Engineering & Building Technology. First there is the energy efficiency. In the construction industry the emphasis of clients' orders has shifted from construction of new buildings to the modernisation of old buildings under special consideration of energy efficiency. Energy efficiency means that the consumption of heating energy will be reduced and ventilation, hot water consumption will be optimised. Another typical issue is the constructional improvement of the insulation of the walls of a building. We are also aware that roofs must be insulated, windows must be modernised and heating systems must be equipped with a heat pump or condensing boiler. Legal parameters lead to more complicated and complex technical requirements.

The building is no longer considered as a line-up of individual crafts, but is considered as an integral system. This is a fundamentally new point of view. All individual measures have to subordinate themselves to this system 'building'. As long as the craftspeople have worked side by side with each other parallel or one after the other consecutively. From now on they have to communicate and coordinate in order to cooperate. We replace coexistence by cooperation. Let me give you an example: There are carpenters who construct roofs; and these roofs are manufactured in an airtight manner in order to keep the warmth inside the house. For this purpose airtight layers are being installed. These layers are being glued together to make the roof airtight. But now the electrician turns up saying: „I have to install the satellite dish.“ By connecting the dish on the roof, he pierces the airtight layer and destroys it. This means of course that there will be constructional damages on the long run. This simple example shows the importance of cooperation between the individual crafts.

Another topic is the protection of resources. The careful handling of natural resources is one of the major global challenges. The construction industry is one of the most resources intensive economic



sectors. In our college we regard all construction materials which we process under a different point of view: We first assess their individual insulation performance. Besides that, we have an eye on the energy that is necessary for the production of the material until its application on the building site, and – later – if it can be reused or recycled or if it can be disposed of properly. We do not only assess its efficiency, that means its insulation performance, but we also keep in mind its energy balance developing along the material's lifespan. Besides the teaching of technical contents, our teachers also face the challenge to create awareness among the students that resources and energy are finite, and thus need to be consumed efficiently. Teachers and students must be sensitised to the fact that our global resources are limited and that we have to handle them with responsibility – and also with respect for further generations.

Which role does the centre play for the profile of your college?

It plays a role in regard of two aspects. First the internal aspect: We are the centre of competence for construction technology in the region of Hanover. Here we have 2500 students being educated in a big variety of crafts. We are aware of the fact that the quality of our vocational education will essentially determine the awareness and the professional performance of the next generation. And this responsibility we want to accept. We all agree on that point. We'll face that. The idea of sustainability becomes more and more the brand mark of our school. This is well accepted also by the teaching staff. The

centre for energy efficient construction and building technology with its pavilions, laboratories and facilities is the outside appearance, what you can see, so to say. The inside central element is formed by the curricular work. This means that we elaborate our learning situations. Learning situations describe complex, life-like tasks within the individual crafts. They are summarised in about 60 to 80 lessons and will convey strategies to the students that will enable them to fulfil their future occupational tasks adequately. The design of these learning situations in full consideration of the idea of sustainability – this is our school's specific know-how. We have a clientele disposing of various degrees of abstraction abilities. This is why we do not only have to consider carefully "what" we teach, but also "how" we do it; we have to give answers to the methodological question. We have to offer various levels of abstraction. We also have to offer our students different representation systems. They must be able to physically touch and see the learning objects and comprehend the contents by using charts. We achieve that by our special methods – the learning situations. The students find here the opportunity to elaborate their ideas. They also have the chance to cooperate with other crafts and to exchange experiences with them.

Now to the exterior aspect: A college is never an isolated entity, but is imbedded into a network of outside partners. Here we have to name the training companies in the first place, followed by the chamber of crafts and the chamber of industry and commerce. We have to communicate with them; and this we do, and we want to use this chance to make this Centre for Energy Efficient Civil Engineering & Building Technology competent and attractive for the market.

In which way were your teachers involved in the process of planning and implementing the centre?

Principally, such a project cannot be realised by any means without the intensive involvement of the teachers. That's impossible. These teachers on the one side are the technical experts in their crafts and have their subject-related expertise. Later on the same teachers have to deal and work with it, day by day. The initial idea for this centre came directly from our college. The colleagues involved in the development of the centre started by forming a planning group. They made up a concept first

and conceptually designed the laboratories, pavilions and the learning contents. Continuously the constructional concepts had to be synchronised with the developed didactical concepts and adapted adequately. The procurement processes of all installations, equipments and the pavilions, the performance description, the financing and the communication with the other TVET stakeholders were within the responsibility of the school management. The construction phase of this centre was observed by the teaching staff. When everything was ready and handed over, an almost unchanged working group continued with the maintaining tasks. Now they are about to try to implement the whole thing into the teaching process: They assess the demand for further training and which equipment items still have to be purchased; they take care of a proper maintenance of all installations and participate in initiatives on federal state and nationwide levels. All the experiences we made show one result: A successful and sustainable support in favour of such initiatives requires a maximum creative elbow-room for the teachers and a full support by the senior management of the school.

How shall the centre be integrated in everyday teaching?

The responsible person is always the head of an individual technical department. All heads of technical departments are at the same time members of this working group. This working group elaborates the specific standards for the learning situations. In addition, the group determines the evaluation criteria for the teaching quality and the methodological procedure. All this is done by the working group. Moreover, they cohere with other subjects like German language or politics – especially related to the term: Sustainability. The challenge of integration is tackled in two steps: In a first step, we check all learning situations in all courses of all crafts up to which extent they reflect energy efficiency, saving resources and sustainability. These learning situations must then be adapted or sometimes even newly phrased, because colleagues might come up with fresh ideas or new requirements have emerged. After this revision process we have to test them. We best exercise this at a project day. At this project day these learning situations will be tested with real groups of students. The students will enter the pavilions and laboratories and

start working there. In the end, we'll evaluate and analyse if we have reached the aspiration level, if the representation systems were adequate, if our methodology was suitable and if we actually have conveyed the learning contents that we wanted to be conveyed. Then we meet again with the whole working group, evaluate and cluster the whole thing and deduce further measures from here.

Now for the second step: This second step means that we want to work interdisciplinary between the different crafts, with the intention that various crafts have to cooperate. But now we face another problem: Maybe the bricklayers have vocational school classes on Mondays, the suppliers on Wednesdays and the electricians on Fridays. This means that the students normally do not meet at school. So we have looked for a solution, how these students can cooperate. On the internet, we have an interactive learning platform, and this platform will be used by teachers and students as a workbench with wikis and glossaries. Students can work at a document together simultaneously; prepare a presentation or similar things. We can summarise it as such: The integration should proceed in a well-planned form including many feedback-loops within the teaching staff, including further training of teachers in order to make them feel secure in their technical expertise, and with a lot of support from the school management.

Other schools might have the idea to build up a similar centre. What advice would you give to interested colleagues? What should be considered to make it a success?

It would be perfect, of course, if the ideas came directly from the teaching staff. Anyhow, it must be

an intensive in-house process of discussions and exchange. Right from the planning phase on, you have to be aware that the operation of such a centre consumes resources. There are financial resources in the first place, because it ties up money that is no longer available for other purposes. A second resource, which schools have, are the so-called mandatory teaching hours: What I give as an input here, I have to take away elsewhere. Both issues will unavoidably lead to an in-house distribution conflict! It is most important to clearly communicate the objectives, which guide you, and to tell transparently, what the resources will be used for. It has to be communicated with the teaching staff how the whole affair will be integrated into the classroom-work and interim achievements have to be celebrated as successes.

Second to that is the necessity to keep up a constant cooperation with the financial authorities. Of course, they also need a certain time frame – that's why they have to be embedded at an early stage of the process, and then again and again to be involved at crucial phases. Moreover, the synchronisation with the extracurricular authorities is very important: These are e.g. the School Authority or the Ministry of Cultural Affairs.

Last but not least, the establishment of such a centre is no day-to-day activity, it is additional, it's on top. What do the school management and the teaching staffs really need to pull through such an object? They need stamina; they need perseverance, and the will for endurance. They need clarity of objectives, clarity of decisions and a constant process of discussions and exchange with the teaching staff. And what you need most importantly is enthusiastic teachers.

The structural change towards a “green economy” is supported by the (South African German) Skills for Green Jobs (S4GJ) programme. It addresses:

- Labour market oriented green skills development;
- Promotion of green technologies and knowledge transfer in small and medium sized enterprises;
- Awareness-raising for climate and environmental issues.

On the German side it is implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ). GIZ collaborates with its national political partners, the Department of Higher Education and Training (DHET), as well as the Department of Science and Technology (DST).

In the context of the “Green College Initiative” the cooperation at national level is extended to the Department of Environmental Affairs (DEA).



Skills for Green Jobs (S4GJ)

Deutsche Gesellschaft für Internationale
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